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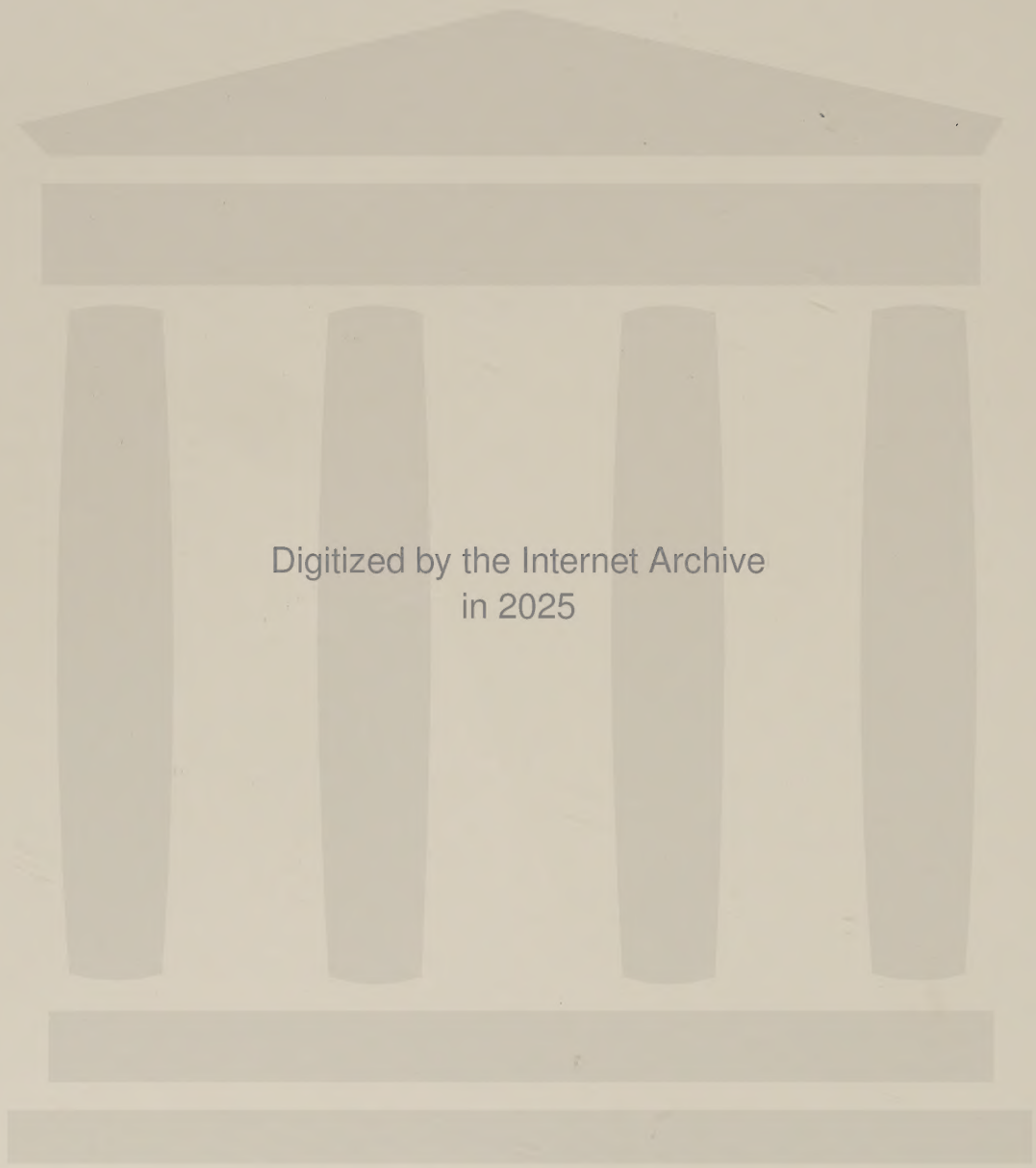
Report of the

FAO/SEAFDEC WORKSHOP ON SHARED STOCKS IN SOUTHEAST ASIA

Bangkok, 18-22 February 1985

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS



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REPORT

of the

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome 1985

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PREPARATION OF THIS DOCUMENT

This document is the final report of the FAO/SEAFDEC (Southeast Asian Fisheries Development Center) Workshop on Shared Stocks in Southeast Asia held in Bangkok from 18 to 20 February 1985. In addition to the main report of the Workshop, the document records the major papers prepared for and submitted to the Workshop including the country reports.

ABSTRACT

It was attended by 26 participants from Hong Kong, Indonesia, Malaysia, Philippines, Thailand and SEAFDEC. The workshop focused its attention and discussion on the following subjects in turn: (1) aims of the workshop, (2) identification of shared stocks, (3) review of biological information, (4) state of exploitation, (5) management of shared stocks, (6) important gaps in knowledge, (7) future research and (8) the regional data base. The workshop identified many of both the "migratory and transboundary (non-migratory) shared stocks in the region, at least 32 stocks of single and grouped species. The workshop clarified the important items to be taken into account for the management purpose of the shared stocks and the major lines to be followed in the future research, data collection and processing including the international collaborations.

Distribution:

FAO Fisheries Department
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Participants
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1. ADMINISTRATIVE ARRANGEMENTS

1.1 Organization and Implementation

The workshop was organized jointly by the Food and Agriculture Organization of the United Nations (FAO) and the Southeast Asian Fisheries Development Center (SEAFDEC) as one of the field activities of the FAO/UNDP South China Sea Fisheries Development and Coordinating Programme (SCSP).

It was held at the Ambassador Hotel, Bangkok, Thailand during 18-22 February 1985 and was attended by 26 participants from Hong Kong, Indonesia, Malaysia, the Philippines, Thailand and SEAFDEC. The list of the participants and staff is given in Appendix 1.

A list of the documents prepared for the workshop and of background papers provided for all the participants, is given as Appendix 3.

1.2 Opening of the Workshop

The Workshop was opened by short statements by Dr S. Chikuni for FAO (Annex 1 a) and Dr V. Hongskul for SEAFDEC (Annex 1 b). Mrs A. Reyes also gave opening remarks for SCSP (Annex 1 c). Dr V. Hongskul was elected Chairman of the Workshop and Dr Chikuni deputy Chairman.

The draft agenda and timetable were adopted (Appendix 2).

2. AIMS OF THE WORKSHOP (Annex 2)

One of the most important results of the extension of national jurisdiction on fisheries to 200 miles offshore has been to reduce the role of international bodies in the processes heading to the management of fisheries resources and to greatly increase the role of each country, which now has total responsibility for the management of these resources within its exclusive economic zone. As a result, those stocks of fish that lie closely within the EEZ of one country can be managed by that country without affecting the interests of other countries. However, many stocks are not limited to a single EEZ but cover more than one EEZ or extend into areas of open sea beyond any EEZ, so they are shared by two or more countries. In these cases the fishing on part of a shared stock in one EEZ is likely to affect the catches on other parts of that stock in the other EEZs. Clearly, any management measures on such shared stocks need to be co-ordinated among the countries concerned to realize the rational utilization of the resources and the harmonious fishing on them by those countries which are under the respective socio-economic conditions (Gulland, 1980; Caddy, 1982).

In southeast Asia the need to study the problem related to shared stocks was soon recognized. At its meeting in December 1979 SCORRAD of IPFC drew attention to a number of shared stocks in the region and in August 1981 SEAFDEC in collaboration with the FAO/UNDP SCSP held a seminar on stock assessment of the pelagic species in the region, with special reference to shared stocks. At this seminar the shared stocks of mackerels (*Rastrelliger* spp.) and round scads (*Decapterus* spp.) were given special attention and the need for better stock identification in general, improved statistics, the standardization of fishing effort and the calling of a regional workshop to go deeper into the problems of shared stocks, were among the recommendations made (SEAFDEC/FAO/UNDP SCSP, 1981).

The 3rd Session of the IPFC Committee for the Development and Management of Fisheries in the South China Sea (CDMSCS), in 1983 the need to pay serious attention to the shared stocks of the region was raised. At the 4th Session of CDMSCS and 21st Session of IPFC in 1984 the need to examine the scientific basis for the rational utilization of shared stocks was again stressed (FAO, 1984, 1984a, 1984b). The Workshop reported here was the outcome of this general concern of the Member Nations in the region with the subject.

The first aim of the Workshop was to identify and list as far as possible the shared stocks in the region, covering coastal pelagic fish, demersal fish, prawns/shrimps and cephalopods. While the need to identify the shared stocks had been recognized for some time, attention so far had been almost completely devoted to the mackerels and round scads, with little attention to any other groups.

Prior to the workshop Mr S. Chullasorn and Dr P. Martosubroto, both FAO Consultants, had been preparing maps of the distribution and other biological information on the important species or species groups as well as making tabulation of biological data relating to them. These would be presented to the workshop and the opportunity taken for participants to correct and add to the information included in them. Similarly, Dr S. Shindo, a FAO Consultant, had been preparing a review of the fish production and state of the stocks in the region and this would also be presented to the workshop for discussion. Having identified the shared stocks, the workshop would review with the aid of the above-mentioned activities the biological knowledge relating to shared stocks and other major stocks that is required for stocks assessment and management purposes, with a view to determining the major gaps in this knowledge.

A similar examination of the requirements for catch and effort statistics would be made to identify firstly what, if any, additional data are required and secondly the gaps and how they could be filled.

The workshop would also look at the role of co-operation between countries to facilitate research on shared stocks, and the role of international organizations such as FAO and SEAFDEC in providing technical assistance on resources research and assessment.

Finally an important aim of the workshop would be to fulfil a request of IPFC/CDMSCS to work into the usefulness of national data centres and a regional data base to handle the data on shared stocks to be used for stocks assessment and for the determination of the effects of alternative management option.

3. IDENTIFICATION OF SHARED STOCKS IN THE REGION (Annex 3)

3.1 General Considerations

In identifying the shared stocks in the region, the definition adopted by the United Nations Convention of the Law of the Sea (UNCLOS) was used, i.e., "shared stocks are the stocks occurring within the EEZ of two or more coastal states, or both within the EEZ and in an area beyond and adjacent to it". Also the workshop found the recent papers by Gulland (1980) and Caddy (1982) very useful in the consideration of the different types of shared stock, and in particular, the workshop recognized the usefulness of distinguishing between the "transboundary shared stocks" and "migratory shared stocks".

A transboundary shared stock was taken to be one in which the fish are non-migratory, but where their area of distribution is crossed by a common boundary between the exclusive fishing zones of two adjacent countries. In the South China Sea region the most common thansboundary stocks are the multispecies stocks of demersal fish which show predominantly a random feeding movement with some on-shore off-shore movement in relation to spawning or the monsoons. Other transboundary stocks are those small pelagic species where there is no definite migration but a more or less continuous mixing through the area in which the stocks lives. It is believed that some coastal anchovy stocks have this characteristics.

The migratory shared stocks include all those migratory species of fish and crustacea or mollusc which have a definite migration beyond the border of one EEZ. The migratory shared stocks can be separated into two groups; the first, which includes by far the largest number, comprises stocks that are restricted to sea areas which are closely within the limit of two or more adjacent EEZs, while the second group comprises those stocks which occur in one or more EEZs and also extend to the open sea beyond. The latter are primarily the larger tunas and billfishes and were not included in the coverage of this workshop.

The identification of shared stocks requires clarity on what is to be regarded as a stock and it was clear that in the region a somewhat flexible definition has at present to be accepted. The aim should always be, as far as is possible, to limit a stock to an assemblage of fish of one species, fishing on which does not affect neighbouring stocks of the same species and which is not affected by fishing on neighbouring stocks of that species.

However, this is rarely possible, especially in tropical areas like Southeast Asia as, among the many pelagic fishes, there are often several closely related species which are typically caught in the same area and not separated by the fishery or the market, and therefore, are not separated in the normal catch and effort statistics. Also in most cases it would take an impracticably large research sampling programme to separate the species. Thus, species grouping may be necessary at least for some species, and at least for the present time.

Also it may not be possible, again at present, to establish the geographic limit of a species due to insufficient information or some interchange between neighbouring stocks. As information increases, so it will be possible to define the stocks more precisely.

The questions were raised whether a stock should be considered as shared if (1) a stock is present in two adjacent zones but only fished by one country or (2) all the young stages, too small to be caught for commercial use, occur in one zone, while all the commercially useful stages occur in the second zones or (3), if the proportion of the potentially useful catch occurring in the second zone is very small - say less than 5% of the potential catch.

The workshop agreed that in all three cases they should be regarded as shared stocks.

3.2 Listing of Shared Stocks (Figure 1)

The workshop then reviewed in turn the most important groups of fish in the region to see which should be regarded as shared. It used as background, the map of the region (Figure 1), originally included in Annex 3, which shows the approximate positions of the boundaries between the zones of national jurisdiction.

It was soon clear that while there was considerable information about a number of stocks in the Gulf of Thailand and off the west Coast of Thailand (Andaman Sea), in both of which areas some successful tagging experiments had been done, information on the limits of many presumed stocks was very limited. For a number of species/species groups the workshop made use of the information on the distribution of fishing as identified by the seminar on pelagic resources assessment held in 1981 (SEAFDEC/FAO/UNDP SCSP, 1981) and the draft maps of resources being prepared by Mr Chullasorn and Dr Mortosubrato (see section 4 of this report), combined with the research experience of the participants. However, it was clear that while there is little doubt that there are shared stocks of these species/species groups in the areas, their limits and the countries involved are likely to be revised as more information is obtained.

3.3 Pelagic Fish - Migratory Shared Stocks

3.3.1 Mackerels, *Rastrelliger* spp. (Figure 2)

The possible stocks of mackerel in the South China Sea area were first identified at a workshop in 1977 (SCSP, 1978b), and they were used in a paper on the allocation of scads and mackerels by Hongstul (1980). Figure 1 in the report of the SEAFDEC Seminar (SEAFDEC/FAO/UNDP SCSP, 1981) gives the distribution of the fishing areas for the mackerels throughout the region.

The species involved are short mackerel: *R. brachysoma* (syn. *R. neglectus*), Indian mackerel: *R. kanagurta* and island mackerel: *R. faughni* all of which occur throughout the area. *R. brachysoma* is the most abundant and is a more coastal species than the other two species which extend further offshore.

In most of national statistics the catches of *R. brachysoma* are recorded separately from the catches of the other two species, *R. kanagurta* and *R. faughni*, which are combined. Consideration should be given to the separation of these into *R. brachysoma* stocks and *R. kanagurta/faughni* stocks but at the workshop the three species were considered together.

The following stocks of *Rastrelliger* spp. were identified:

(1) Eastern Gulf of Thailand

(2) Western Gulf of Thailand to Singapore

(3) Andaman Sea

Figure 1 Map of the area covered by the workshop, giving the approximate positions of the boundaries between adjacent areas of national fisheries jurisdiction based on Morgan *et al.*, (1983)

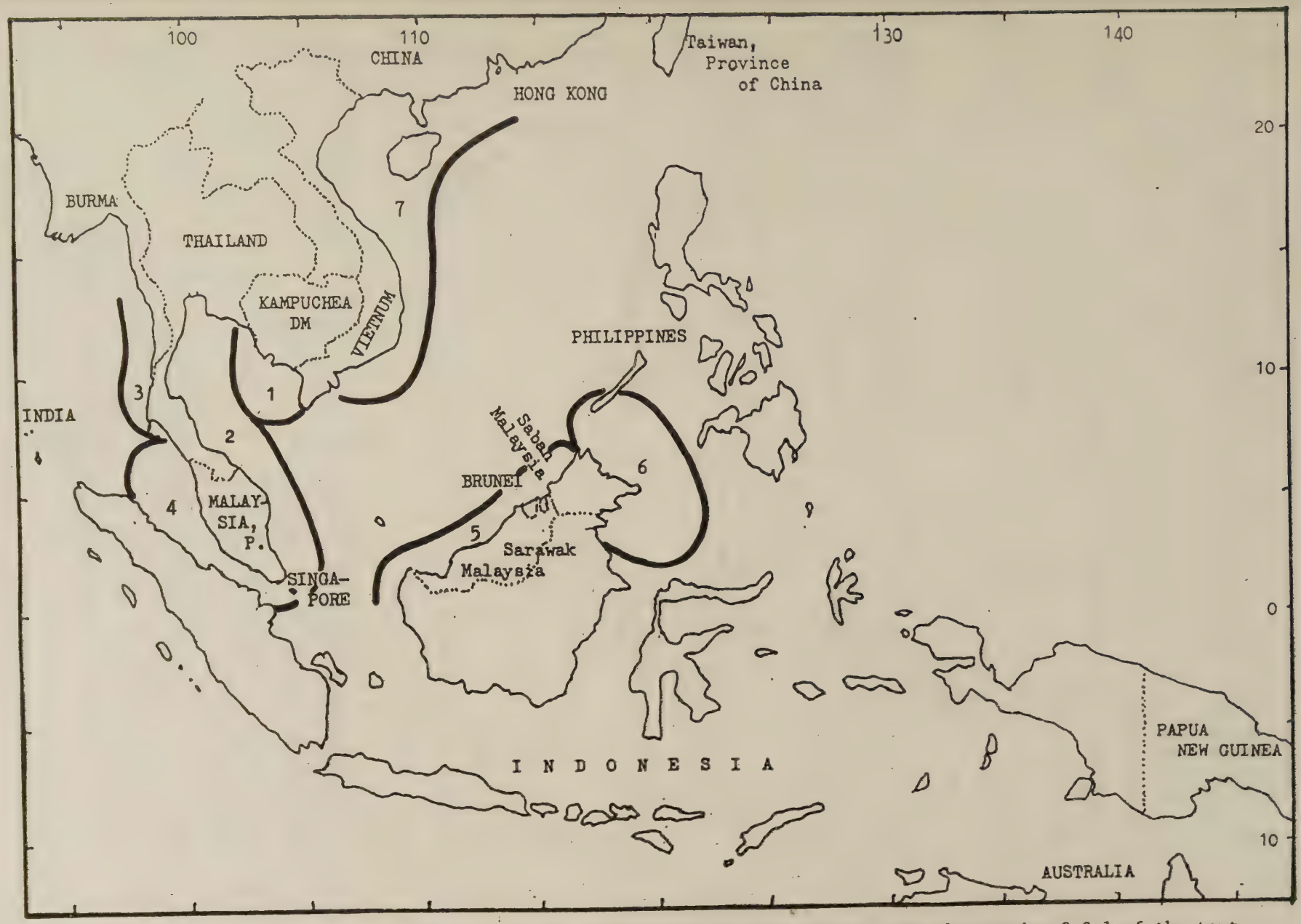

Figure 2 Shared stocks of mackerels, *Rastrelliger* spp. identified in the region. See the section 3.3.1 of the text for details.

(4) Malacca Strait

The view was expressed that these may be two stocks in the Malacca Strait, one on the north side and the other on the south, but the degree of mixing was unknown.

(5) West and Northwest of Borneo

(6) Palawan-Celebes Sea

The limits of this stock are far from clear.

(7) Gulf of Tonkin

In addition, there will be stocks that are not shared in northern Philippines and in Indonesian waters.

3.3.2 Round Scads, *Decapterus* spp. (Figure 3)

Four species are recognized, *D. russelliii*, *D. maruadsi*, *D. macrosoma* (syn. *D. lajang*) and *D. kurroides* but there is uncertainty about the separation of the first two. This problem is not helped by FAO Species Identification sheets as only two species, *D. maruadsi*, and *D. macrosoma* have been mentioned in the sheets. It appears that *D. maruadsi* and/or *D. russelli* would predominate in the catch of all the countries, while *D. kurroides* is not common anywhere in the region.

While the round scads are one of the commonest species in the region, the vast majority caught are immature fish, mature individual being a rarity in most areas and believed to migrate to deeper waters for spawning. However, round scads have been found to spawn in the central part of the Gulf of Thailand. There is an evidence of considerable migrations, though no tagging has yet been done to confirm this.

The following shared stocks of *Decapterus* spp. were identified though there was considerable uncertainty of their limits.

(1) Gulf of Thailand to Sunda Shelf

(2) Malacca Strait

(3) Eastern South China Sea

(4) Gulf of Tonkin

There is probably one or more stocks that are not shared in Indonesian waters.

3.3.3 Sardines, *Sardinella* spp. (Figure 4)

There are some 11 species of this genus in the region of which five are common in a few countries, i.e., *S. fimbriata*, *S. gibbosa*, *S. leiogaster*, *S. longiceps* and *S. sirm*.

The following shared stocks were identified:

(1) Gulf of Thailand to Sunda Shelf

(2) Malacca Strait

Possibly separate stocks on each side of the Strait.

(3) Sunda Shelf-Northwest of Borneo

There was considerable uncertainty about the limits of this stock.

(4) Northwestern Celebes Sea

(5) Gulf of Tonkin

Other stocks which are not shared are known to exist in Indonesian waters, and probably also in northern and central Philippine waters.

Figure 3 Shared stocks of round scads, *Decapterus* spp. identified in the region. See section 3.3.2 of the text for details.

Figure 4 Shared stocks of sardine, *Sardinella* spp. identified in the region. See section 3.3.3 of the text for details

3.3.4 Anchovies, *Stolephorus* spp.

Thirteen species of the genus *Stolephorus* occur in the region, but only two, *S. heterolobus* and *S. indicus* are common throughout. *Stolephorus* spp. are believed typically to form a number of local stocks often, but not always, close inshore. They are believed not to have regular migrations but to move about within a fairly well defined area. The anchovies in the vicinity of the Thai and Malaysian border in the Malacca Strait are considered to form a transboundary shared stock there:

(1) Malacca Strait (east)

There may be several other stocks being shared in the region; however, little information is available to confirm those.

3.3.5 Trevallies: *Caranx* spp., *Carangoides* spp., *Alectis* spp. and *Selaroides* spp. (Figure 5)

The workshop considered that a number of the smaller Carangids which were often caught together could practically be grouped for assessment purposes and should be recognized as forming multispecies stocks. There was some uncertainty as to the species to be included, but decided that the species of the genera *Caranx*, *Carangoides*, *Alectis* and *Selaroides* could be grouped under the general name of Trevallies for a practical purpose. The implication of this grouping from the point of view of getting comparable statistics was not gone into, and the general validity and usefulness of this particular grouping will need further study.

However, on this basis the following four stocks were identified:

(1) Gulf of Thailand to Sunda Shelf

(2) Malacca Strait

(3) North and West of Borneo

(4) Gulf of Tonkin

3.3.6 Hardtail scad, *Megalaspis cordyla*

This species is common throughout the region and is one of the few individual species for which the catches are recorded separately by all countries. While there was not enough detailed information on which to identify separate stocks, it was considered that there were probably three shared stocks. They were identified as:

(1) Gulf of Thailand

(2) Malacca Strait

(3) Gulf of Tonkin

3.3.7 Spanish mackerels, *Scomberomorus* spp. (Figure 6)

While there has been no tagging of Spanish mackerels carried out so far in Southeast Asia, tagging of *Scomberomorus cavalla* in the Atlantic has shown overall movements of 2 800 nautical miles (Williams and Taylor, 1980). If the Southeast Asian species have comparable or even considerably smaller migrations, then wherever Spanish mackerels being caught around boundaries between two EEZs will be a part of a stock shared by at least two countries and probably more. Thus, there may be several stocks in the region, or possibly only one.

The workshop considered that five stocks were possible:

(1) Gulf of Thailand to Sunda Shelf

(2) Malacca Strait to Andaman Sea

(3) Sunda Shelf to Northwest of Borneo

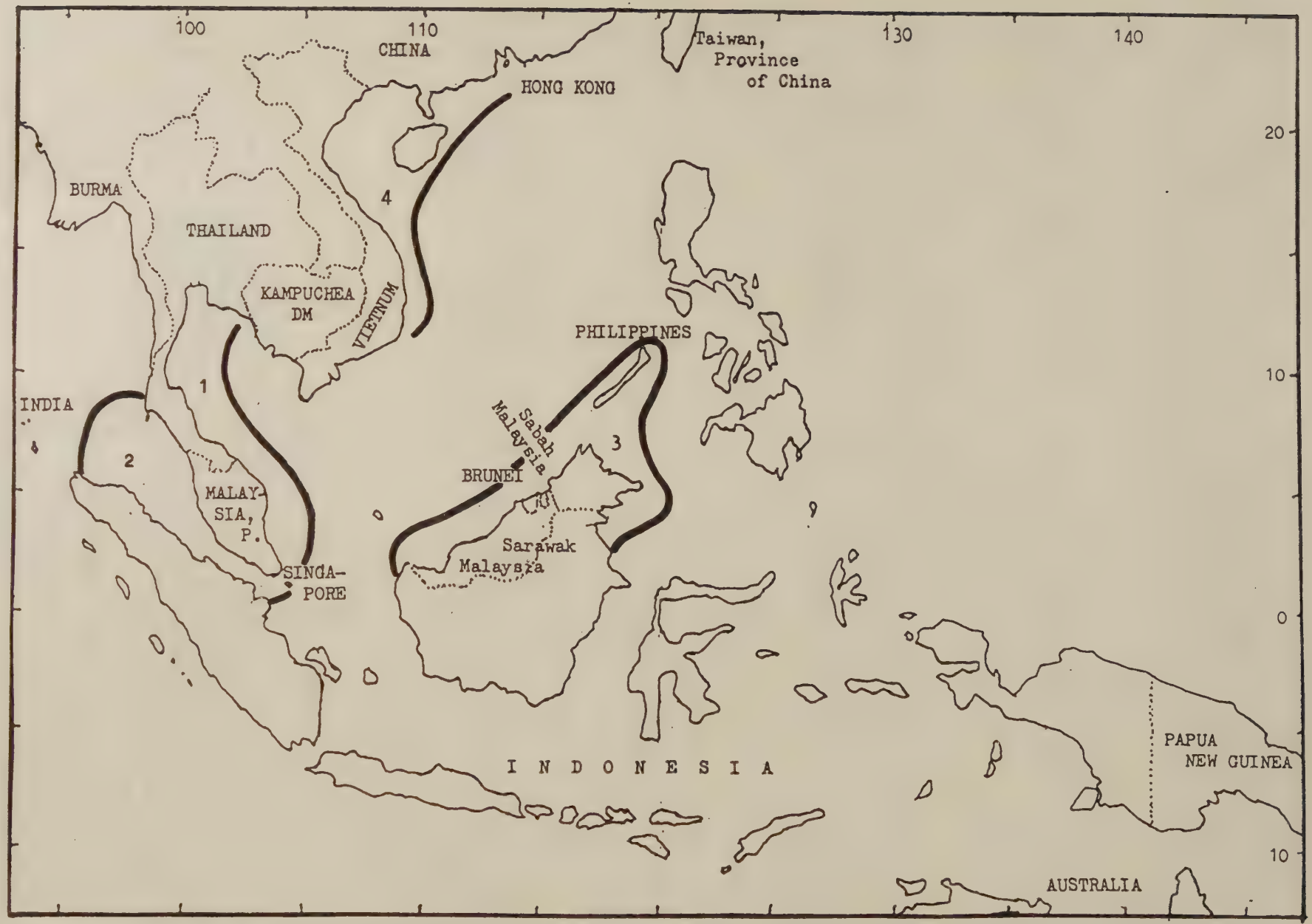

Figure 5 Shared stocks of trevallies, *Caranx* spp., *Carangoides* spp., *Alectis* spp. and *Selaroides* spp. identified in the region. See section 3.3.5 of the text for details.

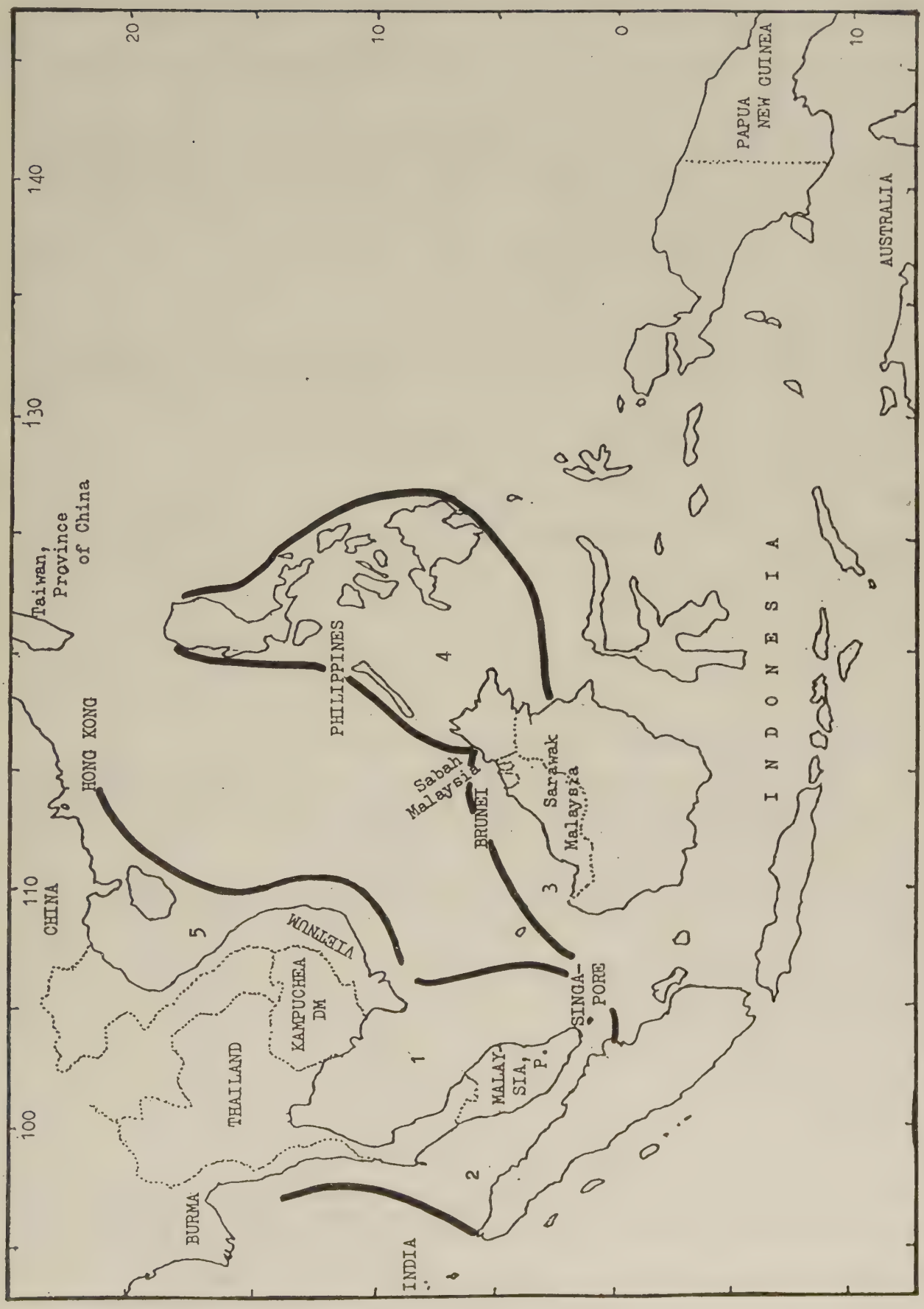

Figure 6 Shared stocks of Spanish mackerels, *Scomberomorus* spp. identified in the region. See section 3.3.7 of the text for details.

(4) Northeastern South China Sea

(5) Western South China Sea

3.3.8 Small tunas: Frigate and bullet tunas (*Auxis* spp.), Kawakawa (*Euthynnus affinis*), Longtail tuna (*Thunnus tonggol*)

Like Spanish mackerel, these small coastal tunas are believed to carry out long migrations, but no tagging has been done and there is not enough information about their movements to suggest the limit of stocks. *Auxis* spp. and kawakawa are common throughout the region, while longtail tuna is common in most areas but rare in the Philippines.

As with Spanish mackerel there may be several stocks of each in the region, but there may also be only one extensive stock of each.

3.4 Demersal Fish - Transboundary Shared Stocks

It was recognized that whereas a boundary between two EEZs crosses a fishing ground for demersal fish then the stock of demersal fish in that area should be considered as a transboundary shared stock.

The following transboundary stocks of demersal fish were identified:

(1) Gulf of Thailand (east)

(2) Gulf of Thailand (west)

(3) Gulf of Thailand to Sunda Shelf

(4) Andaman Sea

(5) Malacca Strait

(6) Northwest of Borneo

(7) Sunda Shelf

(8) Gulf of Tonkin

3.5 Shrimps and Prawns, Penaeidae - Migratory Shared Stocks (Figure 7)

All the fisheries for shrimps and prawns include many species and some 30 species are frequently found in any one area. However, usually 90 percent of the catches are of only some three or four species out of a total of some 12 common species in the region. The important genera are *Penaeus*, *Metapenaeus* and *Parapenaeopsis*.

There are many stocks in the region and their distribution is often related to estuarin and lagoons where the larvae live; but only four of these stocks were identified as shared.

(1) Gulf of Thailand

(2) Malacca Strait

(3) Northeast of Borneo

(4) Gulf of Tonkin

3.6 Cephalopods

3.6.1 Octopus - Transboundary shared stocks

These molluscs, with only a brief planktonic larval phase, are highly sedentary and are hardly eligible to be counted even as transboundary shared stocks. However, for population assessment purposes they are included with the shared stocks of demersal fish.

3.6.2 Small species of cuttlefish and squid - Transboundary shared stocks

The mobility of the smaller species of cuttlefish and smaller species of squid are similar to that of the demersal fish with which they live and are caught. They are counted

Figure 7 Shared stocks of shrimps and prawns, *Penaeidae* identified in the region. See section 3.5 for details.

in with the transboundary shared stocks of demersal fish. Some species come into the shallow water to spawn and move out deeper water during other times. There is a possibility that there are several local stocks.

3.6.3 Large species of cuttlefish and squid. Migratory shared stocks

The larger squids and some larger cuttlefishes are pelagic and undertake considerable migration. There is as yet insufficient information on the distribution of these species in the region to permit the identification of any shared stocks.

4. REVIEW OF BIOLOGICAL INFORMATION

Mr S. Chullasorn and Dr P. Martosubroto (FAO Consultants) had been involved, as part of the FAO Regular Programme, in preparing a comprehensive review of the information on the biology of the important commercial fish resources in the region and of the fisheries on them. As this information was directly relevant to the objectives of the workshop, the consultants presented the information collected so far to the workshop, both to help the discussions of the workshop and to help the preparation of the review paper in filling any gaps in the information.

The information was presented in the form of 19 charts of the region and a series of tables summarizing the biological data. The charts covered the following species or species groups:

Pelagic:	1. Round scads	Demersal:	8. Pony fish
	2. Anchovies		9. Croakers
	3. Sardines		10. Snappers
	4. Mackerels		11. Lizard fish
	5. Spanish mackerels		12. Big eye snappers
	6. Carangids		13. Threadfin breams
	7. Frigate tuna		14. Goat fish
			15. Groupers
Cephalopods:	16. Squids	Shrimps and prawns:	18. Penaeid shrimps
	17. Cuttlefishes		19. Non penaeid shrimps

On each chart were shown the known and believed distribution of the species or species group, the fishing areas, high yield areas and any known spawning areas.

One set of tables showed for over 500 species, the countries of the region in which each species had been recorded and also those countries in which each was important. The second set was based on a literature search and interviews with biologists and research centres in the region, and tabulated available numerical data on one or more of the following parameters for 28 pelagic species, 41 demersal species, 16 species of penaeid shrimps/prawns, 7 species of non-penaeid shrimps and 13 cephalopod species.

Depth distribution	Size at first maturity
Mean length in the catch	Sex ratio
Maximum length	Growth
Spawning season	Mortality
Fecundity	Feeding habit
Recruitment (season)	Length-weight relationship
Recruitment (body size)	

The material was very well received and extensively discussed. It was considered that the charts were too small to show some important details and should include the edge of the continental shelf, also some of the areas of "believed distribution" were considered

to be too extensive and misleading and it might be best to omit this marking from the charts. It was suggested that more biological information could be included on the charts, and that it would be very helpful if the table of biological information included the sources of the data presented.

5. STATE OF EXPLOITATION

Dr S. Shindo (FAO Consultant) presented a preliminary review of marine fisheries production and resources in the region which was the first part of a study on the resources and the present state of their exploitation, that he is preparing. The presentation, based largely on fisheries statistics since 1972 collected by SEAFDEC including the data published in the "Fishery Statistical Bulletin for South China Sea Area", dealt largely with changes in annual catches since 1972 and in fishing vessels since 1978. A large number of tables and graphs were presented covering changes in marine production, catch composition, the numbers, tonnage and productivity of fishing vessels. When complete, the review will be published by FAO.

The Workshop was also introduced by Dr S. Chikuni, FAO, to the papers on the state of fishery resources in the South China Sea and IPFC areas which were prepared by FAO and submitted to the 4th Session of IPFC CDMSCS and the 21st Session of IPFC, Kuala Lumpur, December 1984 (FAO, 1984, 1984 a). The major conclusions were as follows:

(a) Most of demersal fish stocks in nearshore waters have already been heavily exploited, while some offshore stocks still retain some room for further intensified fishing, however, a large increase in the total catch cannot be expected.

(b) Mackerels and round scads in many coastal waters have been fully exploited while the other coastal pelagic species such as sardines and anchovies may retain the potential for some increases in yields.

(c) Smaller tunas such as bullet and frigate tunas, kawakawa and longtail tuna also appear not to have been fully exploited and further increase in the catch can be expected with increased effort.

(d) Almost all the shrimp/prawn stocks in the region have been heavily exploited and the increase in the catch cannot be expected or the total catch would even decline if further intensified fishing is attempted and

(e) Cephalopods are probably the only resources which have an ample room for future intensifying the fishing on them and a substantially large amount of increase in the catch is expected with the intensification/introduction of suitable fishing methods.

6. CONSIDERATIONS ON MANAGEMENT OF SHARED STOCKS (ANNEX 4)

Shared stocks have been divided into the two groups "non-migratory or transboundary" and "migratory". As stated earlier, with the transboundary stocks in the South China Sea area, the movement across the boundaries will usually be very small compared with the size of the stocks within each EEZ. Where this is so, there will be little or no need for each country to take into account the particular interests of its neighbour across their joint boundary when each is formulating its management policy for its part of the stock.

However, where the shelf is wide and the national EEZ is narrow because the national coastline is short the amount of movement across the boundary or boundaries could be large compared with the biomass in the EEZ. In this latter case, heavy fishing on either side of a narrow EEZ could cause a considerable movement from the heavily stocked narrow EEZ to the heavily fished ones on either side, and the country with the narrow EEZ will wish to have a say in the management of the stock which is present along the shelf which includes its EEZ. Thus, while there will be a case for collaboration in the assessment and management of all shared stocks, among transboundary stocks the importance of such collaboration can be expected to depend greatly on the local topographical conditions.

However, the situation with the migratory stocks is quite different, as the movement across EEZ boundaries can affect the fisheries of sharing countries in many ways. Every

situation will be different, requiring good knowledge of the biology of the shared pelagic species. In the first place, knowledge of the limits of the stocks is essential. The knowledge of the spawning time and areas, the nursery grounds, the feeding areas of juveniles and mature fish and the overall seasonal migratory patter which links them together, are also all important. There are still many gaps in knowledge of these biological features of the fish, even of the mackerels and round scads which have been studied more fully than other species or species groups in the region. To fill these gaps there is urgent need for tagging experiments on many species and for detailed catch data on the basis of species, area and season, preferably monthly. Maps are needed showing present knowledge of the shared migratory stocks, and these would help the administrators to understand the problems.

The management of shared stocks needs to take into account many factors. A basic factor is the state of the whole of the stock -whether it is in an expansion phase in which the fishing can safely be increased, or whether it is approaching, at, or beyond the intensity of fishing to give the highest yield from the stock as a whole.

Then to manage a shared stock the countries concerned will need to come to an agreement on the proportion of the total allowable catch (TAC) of the stock that each country will be permitted to take. Other means of sharing the stock, such as on the basis of the number of fishing vessels could be appropriate in some circumstances. But whatever method is appropriate the actual shares will need to take in three main kinds of factors which can be called historical, socio-economic and bio-oceanographic. Historic factors are the proportion of the catch from the stock taken by the sharing countries in previous years. The socio-economic factors are more complicated and include not only the economic returns to each country arising from different management arrangements, but the national objectives for the fishery industry, local development and employment. The third group of factors, the bio-oceanographic factors, are related to the biology and migrations of the fish, for example in a case where the juveniles fish grow up in one EEZ and more to a second EEZ as adults, heavy fishing on the juveniles by one country could leave few adults to be caught by the other country. This could be a case for agreed management which allows both countries to fish only on the adults in the EEZ of the second country, with quotas for each country.

Whatever the state of the fishery and whatever the management measures eventually agreed upon, where a shared stock is for an important species/species group there will be need to make provision at an early stage for the government to have the power to manage and to implement its decisions. This may mean new legislation. It will also mean that management measures such as licensing boats and limiting entry to the fishery can usefully be started early so that administrators and fishermen can get used to them and avoid such problems as having to reduce the fishing effort because of overfishing.

The steps in managing the shared stocks were given by Gulland (1980) as follows:

(1) Choice of strategy;

(2) choice of tactics;

(3) implementation of the chosen action;

(4) evaluation of the action taken.

The first two have already been discussed. The latter two are of equal importance, and whithout adequate implementation and enforcement the best agreement can become useless and management in general discredited. Enforcement is often a difficult and expensive problem and every opportunity should be taken to devise management which can be seen by the fishermen to be in their interests and if possible controlled by their own organizations. Clearly there is a need for cooperation between the scientists to share biological information and fishery statistics and to agree the assessment of the state of the stocks and the effects of alternate management measures. There is an equally great need for cooperation between countries at management level to ensure that the interests and policies of each country are known and understood by the other country or countries and that the management measures that are adopted by each country sharing each stock are mutually acceptable.

Much of the discussion centred on existing cooperation in research and the need to increase this. Considerable emphasis was laid on the importance of tagging in delimiting the various stocks and determining migration patterns. In order to make the tagging experiments successful it was necessary to share between countries the existing expertise in the tagging operation. It was essential to ensure that full information about the tagging and the rewards was reaching the fishermen of neighbouring countries in order to get as large a return of tagged fish as possible. This was a particularly strong case for working together on the shared stocks in the Malacca Strait area.

At present there is a few joint research being carried out in the region: a joint research on tunas by Indonesia and the Philippines; Indonesia is to carry out a joint acoustic survey with Brunei off the West Borneo coast, and Thai biologists are working with biologists from Malaysia on tagging small pelagic fish on the Sunda shelf.

It was stressed that there was a need for increased and continuing cooperation between the stock assessment scientists and the statistical staff at all levels to improve the fisheries statistics. There is also need for a continuing dialogue between the scientists and the administrators so that the scientists understood the approaches of the administrators and so knew if additional biological information was needed; and the administrator could appreciate what sorts of effects would have on the stocks and the catches by different management measures.

It was considered that while much stock assessment work and the devising of suitable management measures will be done through bilateral and multilateral cooperation among countries, there would still be a need for international fora on stock assessment and management.

7. IDENTIFICATION OF IMPORTANT GAPS IN KNOWLEDGE

7.1 Biological Knowledge

In order to make the work of this session manageable and useful it was limited to the shared stocks that had been identified, and to those aspects of the biology which are essential for stock assessment and management purposes.

The shared stocks are set out in Section 3 and the following 9 biological subjects were considered to be essential.

(1) identification of the species included in the stock,

(2) geographical limits to the stock,

(3) migration pattern,

(4) size composition for growth studies and monitoring the stock,

(5) spawning time,

(6) spawning areas,

(7) nursery grounds (area),

(8) growth rate, and

(9) food.

Other biological information such as average size at first maturity, fecundity and predators is useful but these topics were not considered to have the same priority.

The state of existing knowledge in each country relevant to those stocks they share was determined by the use of a questionnaire (see Annex 6). Representation from each of the participating countries completed one questionnaire for each stock they share, putting a figure between 0-5 against each of the 9 subjects to indicate the completeness of their knowledge, from "nil" (0) to "adequate for stock assessment purposes" (5).

The results from the questionnaires showed where knowledge was good and where there were important gaps. The results are here presented and discussed.

7.1.1 Pelagic fish

Mackerels, *Rastrelliger* spp. (Table 1 and Figure 2)

It is immediately evident that the "identification of the *Rastrelliger* species" in the identified seven shared stocks throughout the region has given little difficulty, and they have been studied for all the stocks. However, it is only in the Gulf of Thailand, Andaman Sea and Malacca Strait that information on the nine topics is well advanced, and particularly in the Thai and Malaysian waters. The main remaining gaps in information on these four stocks are the migration pattern, spawning times and spawning areas of the east coast of the Malaysian Peninsular and in Indonesian waters in the Malacca Strait, and the southern limits of the stock in the western Gulf of Thailand.

Information on the biology of the three species involved is probably sufficient in those areas to permit stock assessment to be undertaken on the two major species separately.

Round scad, *Decapterus* spp. (Table 2 and Figure 3)

The problem of species identification remains acute, and until the status of *D. russelli* and *D. macrosoma* throughout the area is sorted out, it will not be possible to treat the main species separately. This problem is reflected in the variable marking for "species identification". Although round scad are an abundant and important food fish, knowledge of the geographic limits of the stocks, their migration, spawning time and areas are generally scanty for all stocks except that in the Gulf of Thailand and there also the information is not yet adequate, getting three or four markings. Biological information on the Malacca Strait stock is very uneven for, while the limits of the stock are fairly certain and a good length measurement has been done, there is no information on migration, spawning areas or nursery grounds.

A major gap in knowledge of the stock in the Philippine waters and possibly other stocks, is the behaviour and distribution of the mature fish, since virtually all round scad caught in the Philippine waters are immature. Biological information on this stock is inadequate in most aspects and, because of its importance to the countries concerned merits urgent and active attention.

Sardines, *Sardinella* spp. (Table 3 and Figure 4)

Most aspects of the biology of stocks 1 and 2 in Thai waters, the Gulf of Thailand and the Malacca Strait have been studied, though in no aspect is the information adequate yet. No information was available on the state of knowledge of the stock in Malaysian or Indonesian waters.

Very little biological information has been obtained about the stocks off West Borneo or in the Philippine waters (stock 4), and while the species are known and some observation on size composition have been made in the northern shelf area, other biological information is very limited.

Anchovies, *Stolephorus* spp.

The one stock in the region which was considered to be shared lies across the Malaysian/Thailand boundary in the Malacca Strait area. Very little work has been done on anchovies in this area though a good deal of research on the biology of anchovies in the Singapore area was done by Tham (1970). It is believed that there are two stocks along the west coast of the Malaysian Peninsular, but these cannot at present be separated.

Trevallies, *Caranx* spp., *Carangoides* spp., *Alectis* spp. and *Selaroides* spp. (Table 4 and Figure 5)

These results show that there have been very few comprehensive studies of the trevallies in any of the four areas where stocks are believed to be shared, though in these areas the countries have fairly good information about the species present. Information on the geographic limits, migrations and spawning areas of the species concerned is almost nil with the exception of *Caranx mate* in the Gulf of Thailand.

Table 1

Mackerels, *Rastrelliger* spp.

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Eastern Gulf of Thailand	2. Western Gulf of Thailand		3. Andaman Sea		4. Malacca Strait					5. West and Northwest Borneo		6. Palawan to Cerebes Sea		7. Gulf of Tonkin
Country	Thailand	Thai-land	Malay-sia	Thailand		Thailand		Malaysia		Indo-nesia	Malay-sia 3/	Indo-nesia	Philip-pines	Indo-nesia	Hong Kong
Species 1/	*R.*	*R.*	*k.*	*f.*	*b.*	*k.*	*b.*	*k.*	*b.*	*k.*	*R.*	*R.*	*R.*	*R.*	*R.*	*R.*
Topics															
1. Species	5	5	5	5	5	5	5	5	5	5	2	2	5	4	3	4
2. Geographic limits	4	4	0	0	5	5	5	5	3	3	0	3	0	2	0	0
3. Migration	4	4	0	0	3	3	5	3	0	0	0	0	1	0	0	0
4. Size composition	5	5	4	4	5	5	5	5	5	5	1	0	5	3	0	5
5. Spawning time	5	5	0	0	5	3	5	5	3	3	0	0	1	2	0	0
6. Spawning area	5	5	0	0	0	0	3	0	0	2	0	0	0	0	0	0
7. Nursery ground	5	5	0	0	3	0	5	2	0	0	0	0	0	4	0	0
8. Growth	4	4	4	0	5	3	5	3	5	5	1	0	5	2	0	2
9. Food	5	5	0	0	5	5	5	5	0	2	0	0	1	0	0	2 2/
10. Others	4	4	0	0	3	3	3	3	1	1	1	0	1	0	0	-

1/ *R.*: Species combined, *k.*: *R. kanagurta*, *f*: *R. faughni*, *b.*: *R. brachysoma*

2/ - : No data

3/ Sarawak, East Malaysia

Table 2

Round scad, *Decapterus* spp.

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Gulf of Thailand to Sunda shelf			2. Malacca Strait					3. Eastern South China Sea			4. Gulf of Tonkin
Country	Thailand	Malaysia	Indonesia	Thailand		Malaysia		Indonesia	Philippines	Indonesia	Malaysia	Hong Kong
Species[1]	*D.*			*mc.*	*mr.*	*mc.*	*mr.*	*D.*	*D.*			*D.*
Topics												
1. Species	3	5	2	4	2	5	5	2	3	2	4	5
2. Geographic limits	4	0	1	3	3	2	2	0	2	0	3	0
3. Migration	3	0	1	0	0	0	0	0	1	0	0	2
4. Size composition	3	3	1	5	5	3	3	1	3	0	0	3
5. Spawning time	4	0	0	5	5	0	0	0	1	0	0	0
6. Spawning area	4	0	0	0	0	0	0	0	1	0	0	0
7. Nursery ground	4	0	0	0	0	0	0	0	2	0	0	3
8. Growth	3	0	1	3	3	0	0	1	2	0	0	2
9. Food	3	0	0	3	3	0	0	0	1	0	0	0
10. Others	- [2]	0	0	3	3	0	0	1	- [2]	0	0	- [2]

1/ *D.*: Species combined, *mc.*: *D. macrosoma*, *mr.*: *D. maruadsi*

2/ No response

3/ Sarawak, East Malaysia

Table 3

Sardines, *Sardinella* spp.

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Gulf of Thailand to Sunda Shelf	2. Malacca Strait		3. Sunda Shelf to Northwestern Borneo	4. Northwestern Celebes Sea	5. Gulf of Tonkin
Country	Thailand	Thailand	Indonesia	Malaysia[1/]	Philippines	Hong Kong
Species	Combined					
Topics						
1. Species	3	3	2	2	3	4
2. Geographic limits	4	3	0	3	2	0
3. Migration	2	0	0	0	0	0
4. Size composition	3	3	0	0	2	3
5. Spawning time	4	3	0	0	0	2
6. Spawning area	4	0	0	0	0	0
7. Nursery ground	3	3	0	0	0	0
8. Growth	3	2	0	0	0	2
9. Food	3	2	0	0	0	0
10. Others	- [2/]	2	0	0	- [2/]	0

1/ Sarawak, East Malaysia

2/ No response

Table 4

Trevallies: *Caranx* spp., *Carangoides* spp., *Alectis* spp. and *Selaroides* spp.

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Gulf of Thailand to Sunda Shelf	2. Malacca Strait			3. North and West of Borneo			4. Gulf of Tonkin
Country	Thailand	Thailand	Malaysia	Indonesia	Philippines	Malaysia[1/]	Indonesia	Hong Kong
Species[2/]	*Cx.*	*C.m.*	*C.x.*	*Com.*	*Com.*			*Com.*
Topics								
1. Species	4	4	5	0	3	3	1	4
2. Geographic limits	4	3	0	0	1	2	2	3
3. Migration	2	0	0	0	0	0	0	0
4. Size composition	5	5	0	0	1	0	0	4
5. Spawning time	2	4	0	0	0	0	0	0
6. Spawning area	3	0	0	0	0	0	0	0
7. Nursery ground	2	0	0	0	0	0	0	2
8. Growth	5	3	0	0	0	0	0	2
9. Food	0	0	0	0	0	0	0	0
10. Others	0	2	0	0	0	3	0	-[3/]

1/ Sarawak, East Malaysia

2/ *Com.*: Species combined, *Cx.*: *Caranx* spp., *Com.*: *Carangoides malabaricus*

3/ No response

The usefulness of including this large number of species of four genera as one stock in these areas needs further study as it would hide any over exploitation that might be occurring on the more favoured species. Also it may be almost impossible to define the limits of any one stock due to different and overlapping distribution of the species concerned.

Hardtail scad, *Megalaspis cordyla*

Table 5

Hardtail scad, *Megalaspis cordyla*

Ranking: 0 (No information) to 5 (sufficient for stock assessment purpose)

Stock	1. Gulf of Thailand	2. Malacca Strait	3. Gulf of Tonkin
Country	Thailand	Thailand	Hong Kong
Species	Single species		
Topics			
1. Species	5	5	5
2. Geographic limits	0	3	1
3. Migration	0	0	1
4. Size composition	3	3	0
5. Spawning time	0	4	0
6. Spawning area	0	0	0
7. Nursery ground	1	2	0
8. Growth	5	3	0
9. Food	0	3	0
10. Others	0	3	- 1/

1/ No response

While identification of the species is no problem with any of the three stocks, and size composition data and information on growth are available for the stocks in Thai waters, in the Gulf of Thailand and Malacca Strait no information has been obtained on the migration and spawning areas, and little is known about the geographic limits and most other biological features of three stocks.

Spanish mackerel, *Scomberomorus* spp. (Table 6 and Figure 6)

Information on the biology of the Spanish mackerel in the region is virtually nil except for the part of stock 1 in Thai waters in the Gulf of Thailand, where most aspects have received a three or four markings. Unfortunately, there were no returns of the questionnaire from Thailand and Malaysia relating to Spanish mackerels in the Malacca Strait. Some length measurements have been made on stocks 1 and 5.

Table 6

Spanish mackerels, *Scomberomorus* spp.

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Gulf of Thailand to Sunda Shelf	2. Malacca Strait to Andaman Sea	3. Sunda Shelf to Northwestern Borneo		4. Northeastern South China Sea	5. Western South China Sea
Country	Thailand	Indonesia	Malaysia [1/]	Indonesia	Philippines	Hong Kong
Species	Combined					
Topics						
1. Species	3	1	2	2	4	5
2. Geographic limits	4	0	1	0	0	0
3. Migration	0	0	0	0	0	1
4. Size composition	4	0	0	0	0	2
5. Spawning time	4	0	0	0	0	0
6. Spawning area	4	0	0	0	0	0
7. Nursery ground	3	0	0	0	0	0
8. Growth	5	0	0	0	0	0
9. Food	2	0	0	0	0	0
10. Others	4	0	0	0	- [2/]	- [2/]

1/ Sarawak, East Malaysia

2/ No response

Smaller tunas (Table 7)

Frigate and bullet tunas, *Auxis* spp.

No information is available on observations on *Auxis* spp. in Thai and Philippine waters, and Indonesia has not yet started its planned biological observation on them. The observations by Malaysia are limited to the east coast of the Malaysian Peninsula and so far have included only length data and preliminary observations on food.

Kawakawa, *Euthynnus affinis*

Thailand has information (2, 3 or 4 markings) on most aspects of the biology of this species in the Gulf of Thailand, but apart from this, the only other observations that exist are length composition and the food of this species off the coast of the Malaysian Peninsula. Length composition observations are being started in Indonesian waters.

There are no biological observations carried out so far on *Euthynnus affinis* in either the Philippine waters or Thai waters along its west coast.

Longtail tuna, *Thunnus tonggol*

Knowledge on the biology of tonggol is very limited with the exception of those in Thai waters in the Gulf of Thailand. Indonesia has just started the study on this species and observations on Malaysia are limited to the East Coast of the Peninsula. Thailand has some data (markings of 2-4) for most of the biological features, but the length measurements are as yet only from drift gillnet catches and for a limited area. No information is available for the Thai waters along its west coast.

No observations are to be output from the Philippines as tonggol are very rare north of the Celebes Sea.

7.1.2 Demersal fish (Tables 8 and 9)

The name of the species referred to in the summary tables are as follows:

1. *Nemipterus hexodon*
2. *N. nematophorus*
3. *N. mesoprion*
4. *N. japonicus*
5. *N. peronii*
6. *N. tolu*
7. *N. tambuloides*
8. *N. delagoae*
9. *Saurida undosquamis*
10. *S. elongata*
11. *Saurida* spp.
12. *Priacanthus tayenus*
13. *P. macracanthus*
14. *Scolopsis taeniopterus*
15. *Sphyraena forsteri*
16. *Lutjanus* spp.
17. *Epinephelus* spp.
18. *Sciaenidae*

Tables 8 and 9 show the state of knowledge of the 9 biological features for 15 demersal species and 3 species groups that occur in the transboundary stocks in the Gulf of Thailand and/or Malacca Strait areas. These demersal stocks have been identified on the basis of where they are corssed by a boundary between two neighbouring EEZs, but in two cases these species extend from one boundary to the rest, i.e., between stocks 2 and 3 in the Gulf of Thailand, and between stocks 4 and 5 in the Andaman Sea/Malacca Strait area. Therefore, some data are correctly recorded or related to two stocks.

It seems that the main gaps in knowledge are concerned with migrations (0 markings for all species), nursery grounds in the Gulf of Thailand and to a large extent also in the Malacca Strait, and spawning areas in the Andaman Sea/Malacca Strait area. While these gaps are not serious for the assessment of the state of these stocks they could be important in assessing the effects of alternative management options.

Table 7

Small tunas

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Species[1/]	Frigate and bullet tuna *Auxis* spp.		Kawakawa *Euthynnus affinis*				Longtail tuna *Thunnus tonggol*		
Country	Malaysia	Indonesia	Thailand	Malaysia P.[2/]	Malaysia S.[3/]	Indonesia	Thailand	Malaysia P.[2/]	Indonesia
Topics									
1. Species	5	3	4	5	2	5	4	5	1
2. Geographic limits	0	0	3	0	1	0	3	0	0
3. Migration	0	0	3	0	0	0	3	0	0
4. Size composition	3	0	4	3	0	1	4	3	0
5. Spawning time	0	0	4	0	0	0	4	0	0
6. Spawning area	0	0	2	0	0	0	2	0	0
7. Nursery ground	0	0	2	0	0	0	2	0	0
8. Growth	1	0	0	1	0	0	0	1	0
9. Food	2	0	2	2	0	0	2	2	0
10. Others	0	0	-	0	0	1	-	0	0

1/ Stock unit is not clear, single or plural

2/ Malaysia Peninsula

3/ Sarawak, East Malaysia

Table 8

Demersal Fish

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Gulf of Thailand (East)						2. and 3. Gulf of Thailand (West) to Sunda Shelf								
Country	Thailand						Thailand								
Species 1/	1	2	3	9	12	14	2	3	4	5	9	10	12	14	15
Topics															
1. Species	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
2. Geographic limits	5	3	5	3	0	0	5	5	5	5	5	5	5	5	1
3. Migration	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4. Size composition	2	5	5	5	3	4	3	3	5	3	5	5	0	5	5
5. Spawning time	3	4	4	4	4	4	4	4	0	4	4	4	0	0	0
6. Spawning area	1	2	1	4	1	2	2	1	0	0	4	4	0	0	0
7. Nursery ground	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
8. Growth	0	5	5	5	0	0	0	0	5	0	5	5	0	0	5
9. Food	1	0	3	3	2	2	0	3	0	0	0	4	4	0	0
10. Others	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

1/ See text for the notation

Table 9

Demersal Fish

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	4. Andaman Sea			4. and 5. Andaman Sea to Malacca Srait					5. Malacca Strait			6. Northwest of Borneo	7. Sunda Shelf	8. Gulf of Tonkin
Country	Thailand			Thailand					Thailand		Malaysia P.[2]	Malaysia S.[3]	Indonesia	-
Species [1]	6	7	16	8	11	12	13	17	1	2	18	Com. [4]	Com. [4]	?
Topics														
1. Species	5	4	3	5	3	5	5	3	4	5	5	2	2	
2. Geographical limits	3	3	3	3	3	3	3	3	3	3	0	1	0	
3. Migration	0	0	0	0	0	0	0	0	0	0	0	0	0	
4. Size composition	3	3	3	5	3	3	3	3	4	5	3	0	0	
5. Spawning time	3	3	3	5	3	3	4	3	3	3	3	0	0	?
6. Spawning area	0	0	0	0	0	0	0	0	0	0	0	0	0	
7. Nursery ground	0	3	2	2	0	2	2	0	0	3	0	0	0	
8. Growth	3	2	2	3	2	2	2	3	2	0	1	0	0	
9. Food	2	2	2	2	2	2	2	2	2	2	2	0	0	
10. Others	2	2	2	2	2	2	2	2	2	2	0	0	0	

1/ See text for the notation

2/ Malaysia Peninsula

3/ Sarawak, East Malaysia

4/ Species combined

In these two areas the species composition of the demersal stocks is not fully known and no biological studies of the speices has yet been undertaken.

7.1.3 Shrimps and prawns Penaeidae (Figure 7)

With regard to stock 1, on the northeast side of the Gulf of Thailand, the only gaps in knowledge of the main biological aspects of the *Penaeus* spp. and *Metapenaeus* spp. relate to migration and growth, other aspects of the biology are well known.

In the Malacca Strait (stock 2) the main gaps are on migrations and spawning areas, while the other aspects have been studied and markings reach 3 or 4 by Malaysia or Thailand or both.

While the Taiwan fishery has been studied by Sabah, the biological information is very limited.

Table 10

Shrimps and Prawns, *Penaeus* spp., *Metapenaeus* spp. and *Parapenaiopsis* spp.

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	1. Gulf of Thailand	2. Malacca Strait		3. Northeast of Borneo	4. Gulf of Tonkin
Country	Thailand	Thailand	Malaysia	Indonesia	Hong Kong
Species	Combined				
Topics					
1. Species	5	3	5	1	2
2. Geographic limits	4	3	3	0	0
3. Migration	2	0	0	0	0
4. Size composition	4	2	2	0	0
5. Spawning time	4	0	4	0	0
6. Spawning area	4	0	0	0	0
7. Nursery ground	4	3	0	0	0
8. Growth	0	3	0	0	0
9. Food	4	3	2	0	0
10. Others	-	3	0	-	-

7.1.4 Cephalopods; cuttlefish and squids (Table 11)

The names of the species referred to in the summary table are as follows:

Squids

1. *Loligo chnensis*
2. *L. duvauceli*
3. *Sepioteuthis lessoniana*

Cuttlefish

4. *Sepia sculeata*
5. *S. lycidas*
6. *S. pharaonis*
7. *S. recurvirostra*

All the species that have been studied and are shown above, are neritic species and have been confirmed to inhabit the continental shelf of the Gulf of Thailand and the Andaman Sea. It is seen that while there is no problem about species identification and a considerable amount of information has been obtained on several aspects of the biology of these species, there is no information on migrations and survey grounds and very little on spawning areas or growth. However, it is noted that no biological observations on squids

and cuttlefishes have been virtually made in the other countries with the exception of Hong Kong.

There appears to have been no studies of the biology of any of the oceanic squids or of any octopus in the region.

Table 11

Cephalopods; cuttlefishes and squids

Ranking: 0 (No information) to 5 (sufficient for stock assessment purposes)

Stock	Gulf of Thailand							Malacca Strait				Gulf of Tonkin
Country	Thailand							Thailand				Hong Kong
Species [1/]	1	2	3	4	5	6	7	1	3	4	7	Combined
Topics												
1. Species	5	5	5	5	5	5	5	5	5	5	5	4
2. Geographic limits	5	5	5	5	5	5	5	3	3	3	2	0
3. Migration	0	0	0	0	0	0	0	0	0	0	0	0
4. Size composition	5	5	5	5	2	5	5	3	2	2	1	3
5. Spawning time	5	5	5	5	0	5	5	3	0	3	0	0
6. Spawning area	1	1	0	0	0	1	0	0	0	0	0	0
7. Nursery ground	0	0	0	0	0	0	0	0	0	0	0	0
8. Growth	0	0	0	0	0	0	0	2	0	1	0	0
9. Food	5	5	5	5	0	0	0	2	0	1	1	0
10. Others	0	0	0	0	0	0	0	2	0	2	0	0

7.1.5 Some conclusions from the review

Reviewing the results of this identification of the gaps in biological information, a few general features emerge. The one clear problem on species identification concerns the species of *Decapterus* and this requires urgent attention.

The most common gaps are knowledge of the geographic limits of the stocks, migration, spawning areas and survey grounds. These are all very important aspects of the biology of the migratory shared stocks. The information of the geographic limits is essential in the first place for knowing just what are the limits of the stocks and therefore what catch and effort data are relevant to each stock for assessment purposes. Then, knowledge of the spawning areas and migration patterns is next important for any allocation of the catches from these stocks. These fields are ones to which greater priority needs to be given. Emphasis on the need for extensive tagging experiments should also be given to define the limits of stocks and to learn about migration patterns.

The area where many of the stocks are shared is the Malacca Strait and a lot of attention is being paid to it, and as has already been pointed out, it is an area particularly suitable for increased cooperation in the planning, and carrying out of the research and in the interpretation of the results.

There has been a considerable increase in the number of species included in size composition monitoring, but there is still a number of important gaps to be filled, of which Spanish mackerel and the smaller tunas are among the most important.

7.2 Statistical Knowledge

The use of catch and effort statistics relating to shared stocks makes certain extra demands on those statistics. At the same time, with the development of the use of computers to handle the national fisheries statistics, careful arrangements for handling the data can make available to the biologist valuable additional information for the understanding of the shared stocks and for assessing the probable effects of different management measures.

The additional demands relate to the need of the countries sharing any stock to be able readily to put their catch and effort data together, to treat the whole stock as one. This, above all, requires standardization of the species breakdown, otherwise individual stocks cannot be analised and larger than species groups or even of genera may be all that is comparable, with serious loss of information. There will also be the need to standardize the unit of fishing effort for the stock as a whole which will at least require each country to be able to standardize its own fishing effort to one unit which can then be equated (if necessary after joint fishing trials on the same fishing ground at the same time) with the standard unit of the other country or countries. If different types of vessels are classified by weight or length then weight and length used should be standardized between countries.

Such standardization between countries may not immediately be possible in every aspect, but a small group of the resource biologists and senior members of the statistical divisions from the sharing countries could work out what could be done readily and what could be done to make other data more useful if modified. The usefulness of catch and effort data to the resource biologist can be substantially increased for the allocation of the appropriate catch and effort to each stock, if these data are related to the areas where the fish were caught as well as to the administrative region of the country in which they are landed, which is the common practice at present. Most statistics collection in the field includes the fishing ground or area, and what is needed is that this information is rationalized, and preferably converted into standard areas such as 30' x 30' rectangles, and included in the computerized data so that catch and effort information can be extracted for research on an area basis.

Most catch and effort data are calculated daily or weekly and often summarized on a monthly basis. If these monthly figures are fed into the computer, the biologist will have a great deal of valuable information by which to study the seasonal movements and/or catchability of the stocks that he is working on. Thus, the main aim should be to have the monthly data on the catch (wt) by species or species group, by each fishing gear, by fishing effort and by fishing area.

At the same time, there are a number of simplifications that can ease the work of collecting the data in the field. For example, where many fishing gears are used, so long as catch and effort is recorded as above for the gears that catch say 80 percent of the annual landings, and including any gear that gives a particularly good index of abundance, then the catch by the remaining minor gears could be put together as "other gears" and there would be no need to collect fishing effort for these other gears. However, such simplification needs to be planned between the biologists and the statistical division to ensure that important information is not lost through amalgamation.

In the discussion it appeared that most countries collect data on fishing areas and that the data are prepared on a monthly basis but they are not always kept separate and available for research. In Hong Kong, where the number of landing places is small, initial landings data by fishing area are available only three months in arrears, while in some countries with many landing centres spread over a large area the national data are not available before two years after collection. It is possible that if the statistics were processed on a monthly basis it could be available more rapidly. The need was stressed for the standardization of the accepted English names of species by different countries, and temporarily, until this was achieved, for annual statistical table to make clear what species were included under the names they used.

8. REGIONAL DATABASE

The importance of collection, processing and dissemination of reliable and timely data and information to scientists, technologists, economists and investors alike is self-evident. The need, however, to collect biological and statistical information on shared stocks is essential, as their rational managment and intelligent development will, in necessity, be based on the available data and statistics.

The Committee for the Development and Management of Fisheries in the South China Sea at its 4th Session (6-8 December 1984, Kuala Lumpur, Malaysia) has reviewed the needs for collecting fishery data for the shared stocks in the region, and recommended that member countries take action to build up the necessary facilities required. The Committee having emphasized the need for the standardization of the data collection forms and harmonized reporting format for exchanging relevant data, has welcomed FAO assistance in the development of national centres, with compatible data collection systems standard input and output formats for data of regional interest.

The workshop felt that establishment of national data centres will require considerable time in identifying their precise functions within the existing national structure, securing funds to operate them and ensuring the regular flow of accurate data for processing.

The workshop has noted that as a first step towards the establishment of national data centres, the present national statistical data collection systems should be reviewed and these missing data elements be identified. Where necessary new sampling surveys may need to be designed and executed. It was also noted that the forthcoming IPFC/IOFC Working Party on Fishery Statistics scheduled to meet early May this year would constitute an excellent forum to discuss these outstanding issues. FAO has agreed to include in the agenda of the Working Party issues dealing with the establishment of data centres. The Summary report of the Workshop will also be made available to the participants of the Working Party as background information.

The following series of actions with a suggested implementation time schedule were proposed:

(1) Member countries will be invited to participate in the forthcoming IPFC/IOFC Working Party on Fishery statistics to exchange further information on the availability of statistical and biological data required for stock assessment and discuss ways and means of collecting missing data elements (May 1985).

(2) Member countries to prepare an inventory of available data on stocks identified as being shared; present them to the Technical Secretary of the Workshop to be processed in FAO (December 1985).

(3) FAO to provide consultant to advise the member countries on the collection of missing data elements, use of standard input forms, to identify those data elements to be exchanged on a regional basis, to evaluate the existing data processing facilities and recommend improvements (February-March 1986).

(4) FAO to organize a Seminar to evaluate the results obtained in the collection of data, use of standard forms and the physical analyses of data in the assessment of the resources and to identify the data reporting format and frequency of data exchange (September 1986).

(5) Member countries to implement the new data collection and exchange system and provide FAO regularly with information on new input forms for the processing of data to be circulated regionally (January 1987).

(6) FAO to compile on a continuing basis a regional statistical bulletin on shared stocks to be distributed to the member countries. The data compiled should meet equally the needs of the scientists and the administrators/managers (January 1988).

Within the available financial and staff resources, FAO will make every effort to meet the member countries needs in the time frame proposed. FAO will also be a repository of the regional data on shared stocks until such time that a regional database can successfully be maintained by a centre in the area.

The participants agreed to look into these proposals, discuss them within their countries and at the IPFC/IOFC Working Party in May, with a view to developing national data centres, but recognized that considerable preparation would be needed.

The Committee for the South China Sea also agreed at its 4th Session that a national data centre should be called a "data centre" instead of "bank" to avoid any confusion which may arise in relation to their infrastructure and functions. The workshop agreed, in this context, that the data to be compiled at the regional level should be called the "regional data base", as was proposed by FAO.

9. FUTURE RESEARCH

9.1 Presentation of National Plans

Representatives of each participating country presented their country reports on current and future research plans. The written reports are appended as Annexes 7a - e. A number of additional points were raised in the discussion.

In Indonesia the total ban on trawling which started in 1980 has had a number of effects on the remaining fisheries. Many trawlers were being converted to gillnetting and other fishing methods, while other vessels were being laid up. At present the demersal stocks are considered to be underexploited , catches by a variety of gears were increasing as well as the average size of the fish caught. However, there is no research project specifically to study the effects of the ban on trawling.

In Thailand an important problem is to obtain good statistics of the small-scale fisheries as the existing number of enumerators is not prooving sufficient.

In Malaysia the inshore stocks are heavily fished, and while it is proposed to continue monitoring these, the main thrust of new work is to investigate the offshore pelagic and demersal stocks.

It is believed that there are no unfished resources off Hong Kong to be exploited, which emphasizes the need for management of those heavily fished. Monitoring is being done by catch and effort data and will include more market sampling for length data. Much attention has been paid to the trawl fisheries and it is now intended to pay more attention to the longline and gillnet fishery.

In the Philippines the programme of sampling for monitoring the stocks is to be extended to new areas and the tuna programme is to be extended to areas other than Mindanao where most observations have been made. It is planned to include tagging of tuna in 1986. Surveys will include acoustic methods and cover general oceanography.

9.2 Better Research

Three aspects of fisheries research were raised. Resource research involves many aspects of the relation between fish, their environment and fishing activities and very often insufficient attention is given to fishing activities. The biologist relies on getting good statistics of fishing effort and often complains if he does not get it, but he needs to know a lot more than a reliable figure for numbers of hours fishing or other unit of effort by different gears. Catches can change substantially by the introduction of some new technology or change in the size or rigging of the fishing gear or the way it is handled or the gradual extension of fishing to new grounds. In island areas the wind direction and strength will play a part in the areas that can be fished by small vessels especially during the monsoon season. As a stock is fished down with increased effort the fishing areas may change as the boats follow the most profitable fishing areas. A particular species may turn from a by catch to a target species due to economic factors, without any endorse in the statistics. These features of fishing activities all affect

the relationship between catch and effort and can turn a straight-forward relationship between catch and effort into data which bear little similarity to that relationship. A fisheries biologist needs to know as much about all aspects of the fishery catching the fish he is studying, as he knows about the fish, and this also involves going to sea on the commercial vessels where he will learn much from the experience of men who have been fishing all their lives. Not only will all this help greatly in interpreting the catch and effort data, but it will allow him to make additional observations or to recommend alterations to the statistics collected, to permit a more correct interpretation of the data.

It would be a most valuable activity if every biologist prepared a detailed account of all aspects of the fisheries with which he is involved and kept it up to date.

A second field for the improvement of research is in the better and fuller use of literature. Many of the problems and methods in fisheries science are basically similar all over the world, but set in different environmental conditions. To neglect the reports on fisheries and the results of fish population studies in other countries can lead to unnecessary duplication of work or to missing the experience of others which can help to advance ones own research. However, when starting a new time investigation it is important first to get as far as possible in working out ones own ideas and plans before searching through the literature; otherwise the researcher slows up his/her own development and confidence in him/herself, and becomes only a follower of others.

Thirdly, the main objective of fisheries research is to find out the facts about the marine resources and the effects of fishing on them, with increasing attention to information needed for management. Much of the work is inevitably by sampling, calculation and deduction and there are many opportunities for loose thinking and faults deductions. The recognition of this fact and the need to combat it, is important. Apart from the need for each scientist to consciously develop a critical attitude to his own work, small group discussions to hear the results of current work and to discuss its results and deductions can play a very valuable part in improving the quality of the work and the general scientific level.

While visiting "experts" help to increase expertise in specific fields there is much that the scientists themselves can do to help raise the quality of their research.

In the discussion the considerable value of bilateral or multilateral workshops in bringing scientists together to discuss their results was stressed. The preparation of reports for presentation at such workshops was also useful. It was stated that scientists need to recognize their own role and to develop their abilities and become better scientists. One problem was that in some countries the scientists were not well paid and that good research workers were left to administration and other work.

9.3 International Collaboration

9.3.1 Bilateral or multilateral basis

The identification of shared stocks and the recognition of the implications for their managements showed the need for international collaboration at several levels. There was the need for scientists to work together from neighbouring countries, both in the research itself and in the interpretation of the results. The importance of tagging in determining the limits of the stocks and migration patterns was a particularly important field for collaboration and it was considered that the Malacca Strait area was one where such collaboration would be very productive. There was a need for collaboration between scientists and numbers of statistics divisions of different countries to work together to standardize certain catch and effort data.

9.3.2 Regional basis

Technical assistance given on a regional basis by suitable international organizations such as FAO or SEAFDEC would undoubtedly facilitate the improvement of resources research carried out in the future by each country. Regional workshops, seminars and training courses on timely subjects are one of the most effective tools to upgrade and update the knowledge of resources and research ability. Regional reviews or studies on resources and fisheries undertaken by these organizations also appear to be extremely useful. The

workshop appreciated being informed of several activities closely linked with the subject which were currently being undertaken and were planned to be carried out in the immediate future by FAO and/or SEAFDEC.

10. RECOMMENDATIONS

In order to facilitate the implementation of the results of the discussions the workshop made the following recommendations:

(1) The identification of the species of round scads (*Decapterus* spp.) still gives serious trouble. As the round scads are an extremely important group in the region, urgent steps are required to solve this problem. The workshop requested FAO to give urgent attention to the appointment of an experienced taxonomist to investigate and report the position.

(2) To assist with the standardization of the identification of the shared species/species groups, the workshop recommended that participating countries should exchange specimens and information as a regular and frequent activity

(3) Acoustic surveys are one of the effective ways to delineate the distribution range of pelagic shared stocks. The workshop therefore request FAO to organize a further training course on acoustic survey techniques in the region to obtain more information on the distribution of shared stocks.

(4) The work aimed at identifying the shared stocks in the area emphasized the need for reliable information on the geographical limits and migrations of the stocks of those pelagic fish which are probably shared. Recognizing the importance of tagging in providing this important information, the workshop requested SEAFDEC to hold a regional workshop on tagging during 1985/86. It also recommended that participating countries should carry out tagging experiments on the important shared stocks of pelagic fish and prawns of which *Rastrelliger*, *Decapterus*, sardines, *Scomberomorus*, the small tunas and *Penaeus merguiensis* were considered to be the most important. Joint research between two or more participating countries is necessary in a number of cases as well as cooperation between countries to ensure that as many recaptured tagged fish as possible are returned.

(5) The review of gaps in the information on the biology of shared stocks showed that while there was good information for Thai waters, it was very limited on a number of the species over most of the rest of the region. It was therefore recommended that in these areas research into the important aspects of the biology needed for assessment purposes should be intensified.

(6) As the cephalopods are probably the main fisheries resources in the region which could yield considerably increased catches, the workshop recommended that research should be intensified on this group. It is believed the larger squids and cuttlefish would form shared stocks. The workshop also requested FAO to look into the possibility of organizing a workshop on the assessment of cephalopod resources in the region.

(7) The workshop recommended that each country continue regular observations on the length composition of the catch of important species of shared stocks and analyse the data to monitor the changes in stock structure and to obtain information on growth.

(8) The workshop recognized that the work of assessment of shared stocks would be greatly facilitated if the statistics of catch and effort of at least these stocks, could be standardized between the countries. The workshop therefore recommended that a small working party of representatives concerned with stock assessment and also those concerned with the collection of national fisheries statistics of each country, should be organized by FAO or SEAFDEC to examine the problems involved and make recommendations for appropriate standardization.

(9) In order to obtain more information required in the region, the workshop considered that research programmes, including resources surveys, should be carried out using available resources of the countries concerned.

(10) The workshop identified a number of stocks in the Malacca Strait area that are shared by two or three countries, Indonesia, Malaysia and Thailand. It considered that this area is particularly suitable for cooperative research and recommended that these countries explore ways of further developing such co-operation.

(11) The workshop recommended the participating countries to strengthen the study of fishery oceanography including the pattern of ocean currents and egg and larva surveys for important shared stocks. The workshop also recommended that the participating countries should make full use of the IOC/SEAFDEC Training Course on Fisheries Oceanography which is scheduled to be held in May 1985.

11. REFERENCES

Publications which have been used as the discussion materials at the Workshop are excluded from this list (see Appendix 3:List of Documents).

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APPENDIX 1

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APPENDIX 2

Agenda and Timetable

		Relevant Documents
	Monday 18 February 1985	
	Morning	
1.	Administrative arrangements	
	1.1 Registration of participants and staff	
	1.2 Opening of the Workshop	
	1.3 Election of the Chairman	
	1.4 Adoption of Agenda and arrangements for the sessions	
2.	Aims of the Workshop	FAO/SEAFDEC:WS/SS/85/2
3.	Identification of shared stocks	FAO/SEAFDEC:WS/SS/85/3
	3.1 General characteristics	
	Afternoon	
	3.2 Listing of major shared stocks	
	3.2.1 Coastal pelagic fish	
	3.2.2 Demersal fish	
	3.2.3 Shrimps/prawns	
	3.2.4 Cephalopods	
	Tuesday 19 February 1985	
	Morning	
4.	Review of biological information	FAO/SEAFDEC/SW/SS/85/4
	4.1 Presentation of draft resources maps	
	4.2 Discussion and revision of the maps	
	Afternoon	
5.	State of exploitation	FAO/SEAFDEC:WS/SS/85/5
	5.1 Presentation of draft resources review	
	5.2 Discussion and modification to the assessments	
	Wednesday 20 February 1985	
	Morning	
6.	Considerations on management of shared stocks	FAO/SEAFDEC:WS/SS/85/6
	6.1 Theoretical needs	
	6.2 Practical applicability	
	6.2.1 National basis	
	6.2.2 International basis	

		Relevant Documents
	Afternoon	
7.	Identification of important gaps in knowledge	FAO/SEAFDEC:WS/SS/85/7
	7.1 Biological features	
	7.1.1 Distribution	
	7.1.2 Migration/movement/displacement	
	7.1.3 Reproduction	
	7.1.4 Other features	
	7.2 Statistics	
	7.2.1 Catch	
	7.2.2 Effort	
	Thursday 21 February 1985	
	Morning	
8.	Future research	
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	Afternoon	
9.	Regional data bank	FAO/SEAFDEC:WS/SS/85/9
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	Morning	
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APPENDIX 3

List of Documents

Discussion Material

FAO/SEAFDEC:WS/SS/85/1.1		Provisional Agenda
	1.2	Annotated Provisional Agenda
	2	Aims of the workshop (S. Chikuni)
	3	Identification of shared stocks (A.C. Simpson)
	4	Distribution and other important biological features of marine resources in Southeast Asia (S. Chullasorn and P. Martosubroto)
	5	A review of the marine fisheries production and resources in the South China Sea area (S. Shindo)
	6	Considerations on management of shared stocks (V. Hongskul)
	7	Identification of important gaps in knowledge (A.C. Simpson)
	8.1a	National plans for research on fishery resources (Philippines)
	8.1b	Research activities in Indonesia
	8.1c	National plan for future research in Thailand
	8.1d	National plans for research and fisheries resources (Malaysia)
	8.1e	The demersal fish resources of the northern shelf of the South China Sea (Hong Kong)
	9	Regional data bank (E.F. Akyuz)
	10	Summary report of the Workshop (Draft)

Information Material

FAO/SEAFDEC:WS/SS/85/Inf.1		Information Note for Participants
	2	List of Documents
	3	List of Participants and Staff

Background Papers

4 Gulland, J.A., 1980 — Some problems on the management of shared stocks. FAO Fish.Tech.Pap., (206):22 p.

5 Caddy, J.F., 1982 — Some considerations relevant to the definition of shared stocks and their allocation between adjacent economic zones. FAO Fish.Circ., (749):40 p.

6 SEAFDEC/FAO/UNDP SCSP, 1981 — Report of the seminar on stock assessment of pelagic resources with emphasis on shared stocks. Bangkok, Thailand, 10-14 August 1981. SEAFDEC, Bangkok, 219 p.

7 Hongskul, V., 1980 — The allocation of scads and mackerels. ICLARM Conf.Proc., (2):1-9

Background Papers (continued)

FAO/SEAFDEC:WS/SS/85/Inf.8 FAO, State of fishery resources in the South China Sea area. 1984 IPFC:DM/SCS/84/9:8 p.

9 FAO, Issues in marine fisheries development and management. 1984 IPFC/84/3:5 p.

10 FAO, Development of national data centres with special refer- 1984 ence to shared stocks. IPFC:DM/SCS/84/6:2 p.

11 FAO, Report of the fourth session of the IPFC. Standing 1984 Committee on Resources Research and Development. Jakarta, Indonesia 23-29 August 1984. IPFC/84/ 4:23 p.

12 Chikuni, S., Cephalopod resources in the Indo-Pacific region. 1983 FAO Fish.Tech.Pap., (231):264-305

13 South China Sea Programme (SCSP), Report of the workshop on 1978 the demersal resources of the Sunda Shelf, Part I. Penang, Malaysia, 30 October - 4 November 1977. SCS/GEN/77/12:44 p.

14 SCSP, Report of the workshop on the demersal resources of the 1978 Sunda Shelf, Part II. Penang, Malaysia, 30 October - 4 November 1977. SCS/GEN/77/13:120 p.

15 SCSP, Pelagic resources evaluation. Report of the workshop 1978 on the biology and resources of mackerels (*Rastrelliqer* spp.) and round scads (*Decapterus* spp.) in the South China Sea, Part I. Penang, Malaysia, 7-11 November 1977. SCS/GEN/78/17:46 p.

16 SCSP, Report of the workshop on management of resources of 1978 the Sunda Shelf, Malacca Strait and related areas, Manila, Philippines, 7-9 December 1977. SCS/GEN/78/18:15 p.

17 SCSP, Report of the workshop on the biology and resources of 1980 penaeid shrimps in the South China Sea area, Part I. Kota Kinabalu, Malaysia, 30 June - 5 July 1980. SCS/GEN/80/26:162 p.

18 SCSP, Report of the workshop on the biology and resources of 1981 penaeid shrimps in the South China Sea area, Part II. Kota Kinabalu, Malaysia, 30 June - 5 July 1980. SCS/GEN/81/30:143 p.

19 Garcia, S. (comp.), Distribution, migration and spawning of 1982 the main fish resources in the northern CECAF area. CECAF/ECAF Ser.82/25(En):9 p. and 11 maps

20 Hayase, S., D. Somjaiwong and S. Chullasorn, Manual on tagging 1984 of marine animals, SEAFDEC Department, Special Publication No.10:67 p.

ANNEX 1a

Opening Statement

by

S. Chikuni
Fishery Resources Officer
Fisheries Department, FAO

Ladies and Gentlemen,

It is with great pleasure, on behalf of FAO, that I extend a hearty welcome to all of you attending the FAO/SEAFDEC on Shared Stocks in Southeast Asia.

I should also like to convey the warm greetings and best wishes of Mr J. Carroz, Assistant Director-General, Fisheries Department, FAO for this meaningful meeting.

For many years the coastal fish resources occurring in Southeast Asian waters had been internationally utilized by two or more nations including both the coastal and non-coastal states. The situation however has changed greatly since the establishment of the new regime of the sea during the later half of the 1970s, and with the extension of national jurisdiction over fishing to 200 miles from the coast, by many of the coastal countries in the region. Free access is no longer allowed by non-coastal states to the resources which fall in these jurisdictional waters. The coastal states have, in other words, now become entirely responsible for the rational utilization of these resources.

However, the necessity to collaborate internationally on research and management has definitely emerged at the same time, for the exploitation of stocks shared by two or more nations, due to the newly adhered to nature mentioned above, and to the biological nature of the living resources. Consideration of shared stocks has now become a common subject to coastal countries all over the world, including this particular region, and the exploration towards rationalization has become one of the focal points by Member Nations in the region, as discussed at the Third and Fourth Sessions of the IPFC Committee for the Development and Management of Fisheries in the South China Sea.

On the other hand it is recognized that information on the stocks currently being shared in the region is rather scant on both its biological and industrial features. Neither a global review of the stocks nor a comprehensive examination of the problems involved have been carried out so far. The workshop will review all the available information and discuss the present state of the important resources and their biological characteristics with special emphasis on shared stocks. The workshop may therefore be regarded as one of the follow-up actions resulting from the above-mentioned requirements of the Member Nations. It is expected, throughout the discussions, that the major shared stocks in the region will firstly be identified. The important gaps in the knowledge of the biology of these stocks and the fishing on them will be clarified. Better understanding on the theoretical and practical needs for the management of shared stocks is also expected to be acquired by the participants. Major lines to be employed in future research, including data collection and processing, and possible international collaboration, will also be clarified.

We believe these outputs expected from the workshop, will be extremely useful to scientists and administrators in the participating countries. Additionally, the success of this particular workshop will be really meaningful to all the institutions and organizations concerned with shared stocks in the world as this is the first occasion on which the subject has been dealt with on a regional and global basis. We do hope, in this regard, that all the participants will take a fully active and constructive lead in the discussions throughout the course of the workshop.

I should at this stage of my statement like to express, on behalf of FAO, our sincere appreciation to the Southeast Asian Fisheries Development Centre for their excellent cooperation with FAO in holding this workshop here in Bangkok. Arrangements made for the

meeting and accommodation provided for us are more than satisfactory. In addition to technical cooperation by the staff of the Centre, the workshop will be supported by a most powerful and efficient secretariat provided mostly by the Centre, which will undoubtedly contribute a great deal towards its success.

I should also like to take advantage of this opportunity to point out that funding for travel and subsistence of all the participants has been borne by the FAO/UNDP South China Sea Fisheries Development and Coordinating Programme.

I am certain that with the continued cooperation of everyone the workshop will be a huge success.

Thank you.

ANNEX 1b

Opening Remarks

by

Veravat Hongskul
Secretary-General
Southeast Asian Fisheries Development Centre (SEAFDEC)

Distinguished Participants, Ladies and Gentlemen,

On behalf of the Southeast Asian Fisheries Development Centre, I would like to welcome you all to this FAO/SEAFDEC Workshop on Shared Stocks in Southeast Asia. Many of you may recall that, in 1981, SEAFDEC conducted a Seminar on Stock Assessment of Pelagic Resources with Emphasis on Shared Stocks and some of the participants who attended that seminar are also participating in this Workshop as well. So it is encouraging to see a follow-up to the past activity organized by SEAFDEC. On our part, SEAFDEC is quite concerned with problems of management and development of fisheries in the region. We are proud to be able to organize this particular Workshop at present with FAO on the matter of crucial importance, i.e. on shared stocks. The Workshop is one of the first meetings of this kind in the world. But it will certainly not be the last in Southeast Asia. We look forward to attending additional forums such as this one which is addressed to problems which exist in the management and development of fisheries in the region. In this connection, I am pleased to inform you that discussion is underway with FAO to conduct a future workshop/seminar concerning fisheries planning, management and development in Southeast Asia. This may be hosted by SEAFDEC in Bangkok during September 1985. It is just one of our activities by which we try to fulfill our objective in assisting our member countries in planning and implementing their research work, with special emphasis paid to the development and management aspects of fisheries.

As host of this particular Workshop, I am very pleased to welcome you all to Bangkok and, if the Secretariat is able to assist you in any way, please do not hesitate to contact us. We also hope that you will have a pleasant stay in our capital for the next few days. I might add that these five working days may be more strenuous than you suppose. We need the full cooperation from all of you in studying the problems seriously in order to be able to draw up viable recommendations for future activities. We believe that, with your first-hand expertise and that of the consultants and resource persons here, we will be able to accomplish something as regards the problems under consideration.

With these brief remarks, now may I declare open the Workshop.

ANNEX 1c

Opening Remarks

by

Aurora B. Reyes
Officer-in-Charge
South China Sea Fisheries Development and Coordinating Programme

Distinguished Guests, Distinguished Participants, Ladies and Gentlemen,

On behalf of the FAO/UNDP South China Sea Fisheries Development and Coordinating Programme (SCSP), let me welcome you to this Workshop on Shared Stocks in Southeast Asia jointly conducted with SEAFDEC.

In the earlier part of the SCSP, substantial activities and workshops had been done dealing with the pelagic and demersal resources of member countries in the Region. Results from those activities I believe would serve as relevant basic data to this Workshop, in addition to those recently made available. It can be noted that the first effort to come up with standardized stock assessment study with special reference to pelagic resources except tuna and tuna-like fishes was in 1980 at the 5th Workshop of SEAFDEC Training Department. It was then followed by the joint SCSP/SEAFDEC Seminar on Stock Assessment of Pelagic Resources with emphasis on Shared Stocks in 1981. Recommendations on the aforestated activities I suppose were appropriately followed-up and/or undertaken.

Now, as we begin with this five-day series review and discussion of available information on hand, we hope we shall be able to accomplish the objectives of this Workshop with the active and serious participation of all concerned. Let the output of this Workshop serve as the input towards a more rationalized management and development of shared stocks in the Region with due consideration to the new regime of the sea.

Finally, as everything has a beginning and an end, this Workshop will be the last major regional activity for the SCSP. It had on the last years adequately performed its coordinative and catalytic role promoting regional fisheries development and management activities.

On this important occasion therefore, in behalf of the Programme and myself as its Officer-in-Charge, the highest appreciation and expressed gratitude is hereby extended to everybody in this forum; to the Governments, Heads/Officials/Staffs of Member Countries; to all the funding and cooperating agencies and to everyone else for their overall contribution and substantial support given to the SCSP throughout the period of its existence.

Thank you.

ANNEX 2

Aims of the Workshop

S. Chikuni
Fisheries Department
FAO

1. Since the later half of the 1970s, many coastal states extended their jurisdiction over fishing to 200 miles from the coast, the sovereignty over the coastal and offshore resources which falls whithin this area has been significantly changed, and also its impacts on the utilization of these resources. There has been no more free access by non-coastal countries to these resources, and restrictions have included not only prohibiting fishing, but also research and exploration on the renewable resources. This implies that the coastal countries are now entirely responsible for the rational utilization of these resources under the new regime of the sea. The scope and magnitude for international collaboration on research and management for these resources has thus significantly diminished in principle and completely disappeared altogether in some extreme cases. The waters of the Southeast Asian region are no exception here, since only two countries, Brunei Darussalam and China, have not extended their jurisdiction as of the beginning of 1985.

2. There is however an absolute need, even under these conditions, or because of the very nature of many living resources, lying within 200 miles of the coast, for international collaboration in resources research and management for those stocks which are shown to be shared by two or more nations. The United Nations Conference on the Law of the Sea (UNCLOS) defines shared stocks as "the stocks occurring within the EEZ of two or more coastal states, or both within the EEZ and in an area beyond and adjacent to it." This implies that the responsibility for the rational utilization of these stocks is being shared by two or more coastal nations in the former case, or that the jurisdiction over the resource by coastal states is incomplete, and that free or conditional access to the stocks by non-coastal countries would commonly occur in waters beyond the coastal jurisdiction, in the latter case. Needless to say, the rational and effective utilization of these stocks cannot be realized unless effective mechanisms for international collaboration on resources research and management are implemented by the countries concerned. It is envisaged that many coastal resources in Southeast Asia fall into this category. In fact, a series of workshops held in the past have confirmed that a few stocks, especially coastal pelagic stocks, are really shared by two or more nations in the region.

3. Many Southeast Asian Member Nations of FAO and SEAFDEC, under these circumstances, have begun to pay serious attention to the importance of the rational utilization of shared stocks in the region. The IPFC Committee for the Development and Management of Fisheries in the South China Sea (CDMSCS) had taken this question up at its 3rd (1983) and 4th (1984) Sessions as one of the important issues to be looked into for future development of fisheries in the South China Sea region. This particular workshop may be regarded as one of the follow-up actions resulting from the above sessions. Details on the discussions held during the CDMSCS Sessions will be provided in a later part of this workshop.

4. Despite the general remarks above, however, there is, at present, insufficient information on shared stocks in the region. A partial review of available information has been made for coastal pelagic fish resources in the South China Sea region at the few workshops mentioned previously. Even in this case, however, species identification of several stocks appears not to have been consistent among the countries concerned, which may also indicate a lack of information or consensus on species identification in the region. The mode of sharing a stock varies greatly according to distribution, migration and movement/displacement patterns of the particular stock on the one hand, and to the mode of deployment and characteristics of fishing in each of the countries concerned, on the other. It appears that the presently availble information on these two aspects is not yet sufficient for all purposes. A global review of available information has not so far been carried out on a regional basis,

but is basic and essential to the identification of the shared stocks themselves, and for the better definition of needs for research and management. The important gaps in our knowledge of resources and fisheries should firstly be identified, and secondly the possibility of international collaboration on research explored.

5. International research collaboration between nations sharing resources aimed at correcting the above-mentioned deficiency may be easier once the target/priority and research plan is agreed by the research institutions, and suitable arrangements are made by the governments. However, it would be extremely difficult in the immediate future to establish a management scheme on specific resources and to implement international collaboration on it due to several political, institutional and technical problems involved. Detailed consideration of practical aspects of such cooperation may therefore be rather premature at this stage.

6. The current problems involved and in moving towards the establishment of a regional data centre resembles those described above in managerial cooperation among the nations concerned. It was agreed at the 4th Session of CDMSCS, under these circumstances, that the national fisheries data centre should first be established on a firm basis before we go into the preparation for the regional data centre, which will be given in further detail during the following sessions of the workshop.

7. Bearing the above-mentioned aspects of the subject and the circumstances in the region in mind, the workshop will review all the available information, and discuss the present state of important resources and their biological characteristics with special emphasis on shared stocks. The review will cover all the major species groups such as demersal fish, coastal pelagic fish, shrimps/prawns and cephalopods, but will exclude oceanic pelagic tunas and billfishes.

8. It is expected that during the course of discussions, the major shared stocks in the region will firstly be identified to both species and location. The important biological information on these stocks for assessment purposes is also expected to be clarified in connection with the global assessment of the identified stocks, and important gaps in knwoledge will, as a result, be identified. The major lines to be employed in the future research will also be agreed on, with respect to subjects, areas and priorities.

9. A better understanding of theoretical and practical needs for the management of shared stocks is expected to be acquired by the participants; however, specific cases within the region will not be discussed for reasons mentioned previously. A consensus on future requirements for improving collection and processing of resource and fisheries data is also one of the highlights to be hoped for from the workshop. It is expected that key practical issues will be clarified, specifically for the establishment of a national fisheries data centre in each of the participating countries, as was recommended at the 4th Session of CDMSCS in 1984. The technical requirements for the establishment of a regional data centre and the practical arrangements for them will also be discussed in substance. It is expected that guidelines for a step-by-step approach towards the regional data centre would be acquired by the participants.

10. Participants will be introduced to the two FAO Regular Programme plans for the review of resources [1/] and biological information on them [2/] in Southeast Asia, which are currently being undertaken by FAO consultants. The provisional results of these studies will be submitted to the workshop as some of the core discussion materials, and will undoubtedly contribute a great deal to discussions. These reviews are also

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1/ "The Fish Resources in Southeast Asia" being prepared by Dr S. Shindo, planned to be published by FAO

2/ "The Distribution and Important Biological Features of Fish Resources in Southeast Asia" being prepared by Mr S. Chullasorn and Dr P. Martosubroto, planned to be published by FAO

expected to benefit from the workshop through active discussion by the participants, and this is also one of the important objectives of this particular workshop, since the final results of these reviews are inseparably related to the subject of the workshop. There is also no doubt that Member Nations will benefit greatly in the future from the success of these studies even outside questions limited to shared stocks. In this connection, participants are kindly invited to actively participate in discussions on relevant matters beyond the specific scope of shared stocks.

11. It is believed that the objectives and results defined above will satisfactorily meet the requirements of Member Nations, both with respect to scientific content and timeliness, and that the workshop will ultimately be extremely useful, not only to scientists but also to fisheries administrators from each country. This should lead towards the implementation of better research and rational utilization of shared stocks in the future, and will surely result in progress in marine science in the region.

ANNEX 3

Identification of Shared Stocks

A.C. Simpson
FAO Consultant

1. WHAT ARE SHARED STOCKS?

A shared stock is any stock whose distribution (a) extends over more than one zone under national jurisdiction or (b) includes the open ocean and one or more zone under national jurisdiction. Any stock which is only to be found in the high seas, but is fished by more than one country would be a shared stock; however, it does not appear that such stocks exist. Put in another way, a shared stock is one whose total area of distribution is crossed by the boundaries of one or more EEZs zone under national jurisdiction.

The identification and listing of shared stocks is done to help scientists and administrators in the wise use and conservation of marine resources and therefore needs to be done with this clearly in mind. Thus, the grouping of shared stocks according to the sort of scientific or administrative treatment required will help and this depends on a number of factors of which the migratory behaviour of the stock is probably the most important. Also some pertinent questions need to be answered which arise out of the variety of life histories of marine animals.

It is essential to stress that it is "shared stock" and not "shared species" that is relevant, though our knowledge of the number and limits of distribution of the various stocks of each species in the area is still very limited and will be a major problem. It is recommended that the board definition of a stock given by Gulland (1980) in his paper "Some Problems of the Management of Shared Stocks" is used. Gulland writes (Page 5) "..... a unit stock (or stock) is an empirical grouping of fish that is sufficiently large, that, when analysing the data concerning it, or taking policy decisions about its exploitation an management, events on adjacent "stocks" can be ignored, or at least treated in a different way to events within the stock. Equally, it should be sufficiently small to be for practical purposes homogeneous, and for possible divisions within the stock, into smaller groupings, to be ignored."

2. SOME CHARACTERISTICS OF TROPICAL STOCKS THAT ARE OF IMPORTANCE WHEN THE STOCKS ARE SHARED

Gulland (1980) and Caddy (1982) have identified three major groupings or categories of shared stocks from the point of view of the type of management they are likely to need, and therefore also the types of scientific appraisal of the options available for management. These groupings depend primarily on distribution pattern and the migratory behaviour of the species concerned. These groupings are applied below to the species occurring in Southeast Asia.

2.1 Non-migratory species

Gulland (1980) calls these "transboundary stocks". This group includes many demersal species. The nursery grounds tend to be towards the shores and there is a general offshore movement in search of food during the life span with limited or virtually no spawning migration. More or less random feeding movements result in general but limited mixing. The group includes the majority of the ISCAAP group 33 and includes most Lutjanidae, Sciaenidae, Serranidae, Pomadacidae, Sparidea, etc. and some Crustacea.

Also included in this group are a few pelagic and demersal species that are almost completely sedentary with fixed demersal eggs, short pelagic larval stages and non-migratory juveniles and adults. These include some reef fish, some gobies and such molluscs as the Whelk (*Buccinum*) and some Octopuses.

2.2 Species with marked, regular migrations and/or long pelagic larval stages, but are not found in the open ocean

These species have migrations such that one or more stages of the life cycle is/are largely spent in an EEZ different from that in which the rest of the life cycle is spent. The majority of the species in this group are pelagic and include many Scombridae, Clupeidae, Carangidae and Penaeid shrimps/prawns and may include some cuttlefish and squid.

2.3 Migratory pelagic species which spend some time in the open ocean and some time within one or more EEZ

This group includes the larger Scombridae that undertake extensive magrations across the open oceans, though their juvenile stages are often within several EEZs. It will also include oceanic squid.

3. SOME QUESTIONS THAT NEED TO BE ANSWERED

Before presenting a draft table of shared stocks in the workshop area, there are a few general questions that need to be considered when deciding whether a particular stock should be included in such a list. These questions are raised here for discussion.

(a) Is a stock to be considered as shared if commercially useful sizes occur in two adjacent zones under national jurisdiction, but only one of the two countries catches them?

(b) Some stocks will be almost completely confined to one zone under national jurisdiction with only a small proportion occurring in an adjacent zone. Should there be a minimum proportion of the total standing stock or of the total catch from that stock in the second zone, for the stock to be considered as shared? Perhaps 1 percent, 5 percent, 10 percent or how much? And if so should a minimum be based on catch or standing stock?

(c) Should a stock be considered as shared if only some or all of the non-exploitable stages of the life cycle, e.g. eggs, larvae and juveniles, occur in a second zone and none of the exploitable stages occur in that zone?

4. NOTES ON THE ACCOMPANYING DRAFT TABLE AND CHART

If a table of shared stocks is to be of use to the scientists and administrators in deciding where efforts should be made to expand or coordinate research between countries sharing stocks, then some measure of the importance and urgency of such action should be included. This will need to take into account the importance of the fishery to one or more of the countries concerned, and whether the shared stock is, or is believed to be, approaching full exploitation or is being over-fished and needing urgent conservation measures.

The table is put forward as a preliminary draft for consideration and improvement during the listing of major shared stocks, item 3.2 of the workshop. However, it is probable that the information presented during subsequent sessions will allow for further improvements to be made and the table should therefore not be finalized until the end of the workshop.

The accompanying chart gives the approximate positions of the existing boundaries of zones under national jurisdiction. Some of these have not yet been finalized. However, future adjustments are not likely to alter the identification of the shared stocks.

Draft listing of Shared Stocks in Southeast Asia	Vietnam	Kampuchea	Thailand		Burma	P.Malaysia		Singapore	Indonesia	Sarawak	Brunei	Sabah	Philippines	Hong Kong	China	Non-coastal
			E	W		E	W									
Demersal	1	1	1,2	3,4	3	2	4			5	5					
Octopus	1	1	1													
Euthynnus affinis			1	2	2	1	2		2,3				3			
Tonggol	1	1	1,2	3	3	1,2	3		3							
Auxis spp.																
Scomberomorus commersoni	1	1	1	2	2		2		2,3			3	3			
Rastrelliger	1	1		2	2					3	3	3	3			
Decapterus	1	1	1	2			2			3	3	3,4	4			
Selar crumenophthalmus																
Megalaspis cordyla																
Sardinella																
Barracuda																
Chirocentrus dorab				1			1		1							
Flying fish (Exocoetidae)																
Penaeidae										1	1	1				
Squid	1	1	1	2	2		2		1,3				3			
Cuttlefish																
Big-eye tuna									1				1			1
Yellowfin tuna									1				1			1
Skipjack									1				1			1

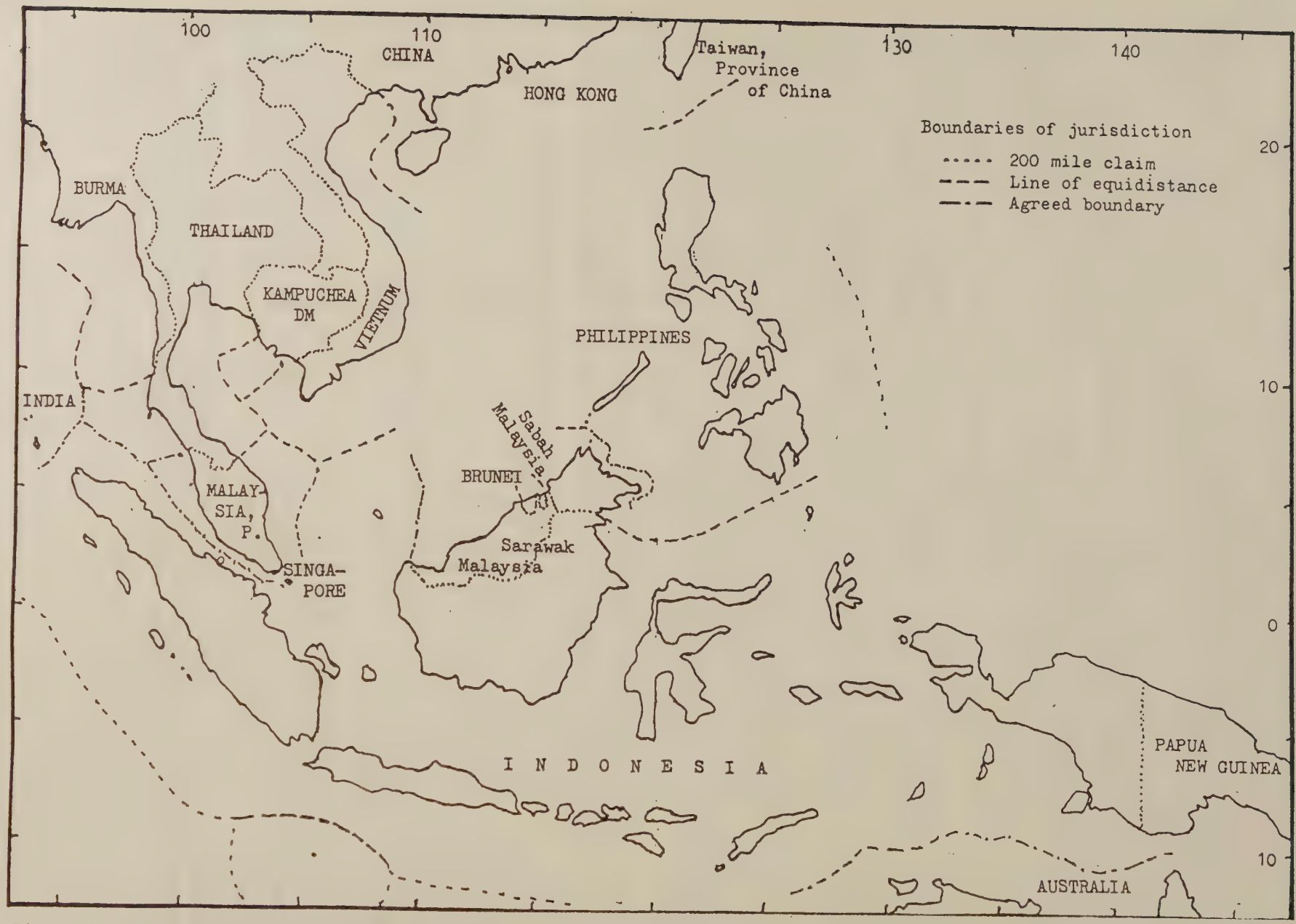

Figure 1 Map of the area covered by the workshop, giving the approximate positions of the boundaries between adjacent areas of national fisheries jurisdiction based on Morgan *et al.*, (1983).

ANNEX 4

Considerations on Management of Shared Stocks

Veravat Hongskul
Southeast Asian Fisheries Development Centre

1. At Montego Bay, on 10 December 1982, the Third United Nations Conference on the Law of the Sea (UNCLOS III) adopted the United Nations Convention on the Law of the Sea. This Convention establishes the specific legal regime of the exclusive economic zones (EEZ) in which the coastal state "has sovereign rights for the purpose of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the water superjacent to the sea-bed and of the sea-bed and its subsoil, and with regard to other activities for the economic exploitation and exploration of the zone ....,"[1/] whereas the EEZ shall not extend beyond 200 nautical miles from the baselines from which the breadth of the territorial sea is measured.[2/]

2. By virtue of this Convention and the ensuing legal acts passed by countries, nearly all fishing grounds which contribute about 99 percent of the world catch have been included within the limites of the area of extended jurisdiction of coastal states. The state within whose jurisdiction the fishing ground falls will have full responsibility for research, management and control of fishing operations on that ground.[3/]

3. Such "nationalization" of the fish stocks in these fishing grounds has had an effect only on the foreign fishing fleets, and not on the stocks themselves. The fish continues to follow its instinct and biological demand for feeding and spawning by moving freely across boundaries from one EEZ to another. It also carries no passport to identify its nationality, thus creating difficulties in determining its owner once it has been fished by fishing fleets of different nationalities offshore.

4. The classification of the fish stocks in relation to boundaries is given broadly by Gulland (1980: 6) as follows:

   (a) Stocks lying wholly within a single national jurisdiction.

   (b) Stocks occurring two or more EEZs, with movement across boundaries but no clear migratory pattern (transboundary stocks).

   (c) Stocks occurring in two or more EEZs, with a clear pattern of movement between one zone and another.

   (d) Stocks occurring wholly on the high seas beyond national jurisdiction.

   (e) Stocks occurring both on the high seas and within one or more national jurisdictions.

5. Further sub-classifications of these stocks were given by Caddy (1982:18-20). However, for the purpose of this study, only the above groups (b) and (c), which may be shared and thus require joint management by more than one coastal state, will be discussed.

6. The transboundary stocks (Group b) are usually considered as local stocks (Group a) and not shared stocks. These stocks do however move continuously across the boundary between adjacent zones. If two countries have a coast adjacent to each other along the edge of the continent, with the same species occurring in both countries, then there will almost certainly be some interchange across the boundary,

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1/ Article 56.1(a) of the Convention

2/ Article 57

3/ Articles 61 and 62

even in the absence of any systematic migratory movement. Gulland (1980:7) cited the example of south and southeast Asian countries where small-scale fishermen exploit to a large extent the same group of species, the differences between one country and another being mainly in the local ecological conditions. Across most boundaries of national EEZs, e.g., between Thailand and Malaysia, or India and Bangladesh, there will be interchange, but the fish concerned will probably not move far and the conditions of the stock tend to be similar on either side of the boundary. A balanced movement across the boundary will depend on the intensity of the fishing effort on each side, as well as on the species of fish exploited.

7. In terms of shared stocks for which a clear pattern of movement can be distinguished between one EEZ and another, Group c is the most important. This group includes many important stocks of demersal and pelagic fishes whose migration between separate spawning and feeding areas occurs on a seasonal basis. Caddy (1982: 19-20) gave four sub-categories of this group as follows:

(a) species spawning within a well-defined area of one EEZ, but ranging widely through two or more EEZs as adults;

(b) species breeding in or above the littoral zone, on the open sea coast, but which have a high-sea distribution, or occupy two or more EEZs as adults;

(c) anadromous species spawning in estuaries and rivers, but which are fully marine as adults, or those spawning in coastal logoons and marshes but where the adults are fully marine and may in both cases have a high-sea distribution in two or more EEZs; and

(d) those species that, although free-spawning at sea, have specific and localized coastal nursery areas for post-larval growth, although they move offshore again as adults.

8. For many migratory species, the seasonal cycle of migration may take them from one EEZ, where feeding and biomass growth will take place, to another EEZ where spawning occurs, and then possibly even to a third EEZ where larval and juvenile development occurs. Fishing in any one area will affect fisheries in the other areas, in terms of abundance of spawners and recruitment having survived previous fishing activities. Furthermore, since migratory species are rarely homogeneous in size and local abundance throughout their range, the coastal countries may be obliged to exploit the resource at a size and level of fishing intensity which will not enable the exploitation of the stock at its optimum yield.

9. Many important fishery resources in Southeast Asia are shared stocks. Hongskul (1980) discussed the possible areas of mixing and problems concerning the allocation of the mackerel (*Rastrelliger* spp.) and scad (*Decapterus* spp.) resources in the Gulf of Thailand, South China Sea and Malacca Strait. In most cases, however, little information on the migratory patterns is available.

10. At the Seminar on Stock Assessment of Pelagic Resources, with emphasis on shared stocks, organized by the Training Department of the Southeast Asian Fisheries Development Centre in 1981, the participants noted that there were likely to be several shared pelagic stocks in the Southeast Asian region.[4/] The economically important resources identified were Indo-Pacific mackerel, Indian mackerel, Spanish mackerel, scad, sardine, anchovies, hardtail scad, selar scad and trevallies. It was also stressed that a serious constraint in the identification of shared stocks was the lack of catch data compiled by species.[5/] It was suggested that seasonal data would be useful,[6/] and the Seminar recommended the use of tagging [7/] to identify the stocks.

4/ Para. 31 of the Report

5/ Para. 7

6/ Para. 41 of the Report

7/ Recommendation 2

11. The economic importance of shared stocks has generally been recognized by the coastal states concerned. It also appears that, in order to devise a sound management strategy for these stocks, regional cooperation is required at different levels.

12. A clear understanding of the geographical distribution and occurrence of transboundary and shared stocks is an important factor for effective management. A series of maps of the resources should be prepared showing the distribution of the resources and their landings in relation to the EEZ boundaries.[8/] These maps could assist the national management authorities concerned in determining the stocks that could possibly be shared with neighbouring countries and in selecting criteria on the basis of which regional consultations on the management of shared stocks could be held.

13. In considering management measures for the exploitation of shared stocks within and beyond its EEZ, a coastal state will have to select criteria for assessing its share of the stock taking into consideration the objectives of national fisheries programmes. General criteria were proposed by Caddy (1982:22-23) as follows:

(a) Historical criteria which take into account the national catches in the past years;

(b) socio-economic criteria which take into account the existing fleet size, current investment and employment; and

(c) bio-oceanographic criteria which take into account the biological characteristics of the stocks, suitable fishing areas, optimum size and optimum yield.

14. The historical criteria were first used in the north Atlantic fisheries (see Brander 1978). ICNAF (1969) recommended that "the shares of participating countries should be based mainly on historical performance, with a small proportion of the total allowable catch (TAC) set aside for new entrants in the fishery, for non-member fishing countries, for member countries with developing fisheries, for coastal state preferences and for fleets of member countries which were incapable of being diverted to other fisheries". These principles of allocation are now considered to be largely irrelevant (Gulland 1980:15).

15. The socio-economic criteria are more difficult to identify. Caddy (1982) developed a computer programme on competing fleets for shared stocks which showed that unilateral increase in effort of one fleet would result in loss of benefits of another fleet. Further increases in effort, i.e. unrestricted competition, result in economic loss to all parties. Fisheries agreements, based on a good understanding of the resource, are therefore required to protect the economic benefits of all parties. This is also true for multifleet fisheries in one EEZ under a single management authority.

16. There are many other socio-economic criteria to be considered. These, however, depend on objectives of national fisheries programmes, economic infrastructure, the state of development of the fishing industry (including that of foreign partners), the marketing and distribution system of the catches, etc. These economic criteria, once they are defined, could guide national management authorities in determining

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8/ FAO is preparing a series of maps on distribution and important biological features of fish resources in Southeast Asia, to be printed by FAO (S. Chikuni, FAO/SEAFDEC:WS/SS/85/2).

the country's allocation of the stock depending on the importance of the shared stocks in the economy. This, however, will not be a guaranty for the wellbeing or continued productivity of the stocks.

17. The biological criteria are probably the most important but also the most difficult to identify. This requires a good knowledge of the location of the spawning areas, the nursery gounds, and the main feeding grounds of the adult fish, as well as the areas where the actual catches are taken. It is also desirable to know how the oceanographic conditions in these areas affect the productivity of the stock, its reproduction as well as recruitment, and the growth and mortality of the individuals. Unfortunately, this type of information is scarce or absent for many stocks, which suggests that a large cooperative research effort will be needed if the allocation of shares in a common stock is to have a sound basis.

18. The need for regional and international collaboration on the management of shared stocks has been recognized. Article 63 of the Convention calls upon the coastal states concerned to seek, either directly or through appropriate sub-regional or regional organizations, to agree upon the measures necessary to coordinate and ensure the conservation and development of such stocks within the EEZs and in an area beyond and adjacent to the zones. The convention however does not specify the nature of such coordination, or the degree to which it depends on the biology and behaviour of the stocks.

19. As a first step, cooperative efforts between States concerned in research on species distribution, length/size composition, maximum sustainable yields (MSY) and total allowable catch (TAC) would be useful to acquire a better knowledge of the stocks to be shared.

20. Negotiations between the countries concerned would be required to reach an agreement on the shares to be taken by each country, on the basis of mutually acceptable criteria. The resource could be allocated using different methods. Ideally, the share of each country should be determined on the basis of the total allowable catch (if it is known) applicable to all fishing fleets. Another possibility is to divide the resource by assigning a delimited area and time limit to each fishing fleet. A monopoly could also be granted to one fleet with the profits being shared by all parties concerned. The most practical method would still be the management of the resource by separate fleets with a ceiling on the catch established through regular consultations among the countries concerned on the state of the stock to ensure its conservation. It is however unlikely that any single formula or principle can be used for determining allocation in all situations. At the same time it is probable that the allocation of any given stock will not remain constant.

21. In order to revise the allocation of the stock at regular intervals, data on the production by each fleet should be collected and compiled regularly. The size and composition of the catches from each fishing ground, spawner size and recruitment success as well as other biological factors should also be closely monitored.

22. The selection of criteria and the allocation of shares of the resources are important steps in the management of shared stocks; it should be stressed however that, without adequate enforcement, the best agreement cannot be implemented. It is therefore the responsibility of the management authorities to regulate the fishing fleets in such a way that they follow the agreement strictly for the sake of future cooperation.

23. International cooperation could play an important role in the management of shared stocks. Technical assistance from the appropriate regional or international organization could facilitate research in order to clarify the complexity of stocks and their environment for their long-term management. Moreover, international organizations might provide a forum where data and other technical information on shared stocks could be exchanged. Such a forum would assist fisheries experts and planners in the region to devise the most appropriate management strategy of shared stocks.

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ANNEX 5

Identification of Important Gaps in Knowledge

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Biological research is well known for the almost infinite variety of aspects that can be studied. However, the luxury of investigating the fascinating but less important topics is not for the fisheries scientist who has the responsibility of advising the administrators on the options open for the management of shared stocks. For the fisheries scientist there is much more information required on these stocks and it is necessary to identify the gaps in the important, that is, the essential knowledge - and even among this it is necessary to give the filling of these gaps some priorities, to ensure that assessments are not held up for the lack of data which has been overlooked or put at the bottom of the list.

In the investigation leading to the management of shared stocks, the first aims, as with stocks that are not shared, are to define the limits of the stock, to determine the shape of the yield curve, the position on that curve of the fishery by all countries, and the potential yield of the stock. Meanwhile, the researchers proceed to put together the information needed by the countries sharing the stock, to work out the most appropriate management measures.

It is therefore recommended that, for each of the shared stocks identified during part 3 of the agenda of this workshop, the gaps in knowledge are identified by seeing how adequate is the information required for:

(a) delimiting the stock;

(b) making an assessment of the state of the stock and of the fishery on it;

(c) providing the information needed for management.

The method used for the assessment will largely determine the data required, i.e., good catch and effort data are required for both the surplus yield (Schaefer/Fox) type models and the dynamic pool (Beverton and Holt/Ricker) type models, while growth and mortality data are also required for the latter. The smaller pelagic species present particular problems due to the difficulties in measuring fishing effort, the large natural fluctuation in year class strength and the dynamic interaction between species. Therefore, additional biological data are necessary. Much of the biological data required can be derived from extensive carefully planned length frequency data, linked with the gear used and mesh selection data for that gear, the location of capture and knowledge of the distribution and migration pattern of the stock.

While these methods are all relevant, and where possible more than one method should be used, catch and effort data are essential to all of them, and therefore high priority needs to be given to identifying and filling the gaps in the information available on catch and effort. It must also be taken into account that inaccurate or unreliable data can be a more serious handicap than no data.

On this basis it is proposed to search out, identify and record the important gaps in knowledge for each of the shared stocks by seeing how adequate is the information available under each of the following headings.

ESSENTIAL		HELPFUL
1st priority	2nd priority	3rd priority
I. Definition of the stock 1. Identification of the one or more species involved. 2. Geographic limits of the stock.	1. Extent of interchange with other stocks of the same species.	
II. Biology 1. Movement/migration pattern. 2. Size composition of catch by different gears and overall. 3. Growth rates (small pelagic).	1. Spawning area and season. 2. Nursery grounds. 3. Mean size at first maturity (males and females). 4. Food, related to size and season. 5. Growth rates (demersal spp.).	1. Natural mortality rates related to size. 2. Natural variation in year class strenght. 3. Juveniles caught in trash fish.
III. Fisheries data 1. Catch (wt)/gear/month/area. 2. Effort/gear/month/area standardized nationally and between the countries sharing the stock.	1. Mesh selection. 2. Fishing mortality rates.	
IV. Socio-economic data	Costs and earnings of fishing and associated industries.	Monthly changes in first sale price of the fish, and in quality. Alternate employment available.

ANNEX 6

Copy of the Questionnaire Used for the Identification of the Important Gaps in Biological Knowledge

No. _____

Country: _____

Stock/species: _____

Area: _____

Factor	Information available*	Remarks
1. Species		
2. Geographic limits		
3. Migration		
4. Size composition		
5. Spawning time		
6. Spawning area		
7. Nursery ground		
8. Growth		
9. Food		
10. Others		

*put figure 0-5,0 = No information

5 = Sufficient for stock assessment purposes

Filled in by:

_____

Date _____

ANNEX 7a

Country Report - Hong Kong

The Demersal Fish Resources of the Northern Shelf of the South China Sea

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Introduction

The demersal fish stocks on the northern shelf of the South China Sea are the major resource exploited by the Hong Kong fishing fleet. The fishery is a multi-gear fishery and provides the major part of the total fish production consumed by the local population. Total production by the Hong Kong fishing fleetin in 1984 amounted to some 191 807 tons of which 135 370 tons or 71% was produced by trawlers while a further 37 682 tons or 20% was produced by long liners and gillnetters. This total production compares with a total production of 127 574 tons in 1973 representing an increase of 42%. Some of this increased production has arisen from extension of the fishery to the East China Sea, with an estimated 16% of total production coming from this area in 1983 (Lee and Chong, 1984). A substantial proportion of the increase in total landings since 1973, however, has been derived from the northern shelf and has been accompanied by a substantial decrease in catch per unit effort (Lee and Chong, 1984).

An assessment of the demersal resources of the northern shelf and the level of exploitation was made by Shindo (1973) for the pre (1931-38) and post (1956) war years and concluded that at the post war level the resource was laready heavily exploited. Aoyama (1973) extended and updated the assessment of Shindo and concluded that while the coastal zone (0-50 m) was overexploited, the 50-500 m zone might be able to withstand a little more exploitation. In a recent review of the marine resources of Southeast Asia, Morgan and Valencia (1983) concluded that the demersal fish stocks on the northern shelf were subject to intensive fishing pressure and were considered to be heavily fished. They also indicated that landings from the South China Sea by China and Taiwan, which together with Hong Kong are the major exploiters of the fish resources on the northern shelf, had tended to increase over the period 1970 to 1980 indicating an increase in fishing pressure by these countries over that period. A decline in landings was recorded by China between 1978 and 1980, however, and what proportion of these landings was derived from the northern shelf is not known.

Trawling surveys of the demersal resources on the northern shelf were conducted by the Agriculture and Fisheries Department, H.K., in 1972-73 (Chilvers, 1973) and in 1984. This paper presents preliminary results of the 1984 survey, compares the findings with those presented by Chilvers (1973) and looks at the current status of the demersal resource in relation to the increased level of exploitation.

Methods

Trawling was carried out on a quarterly basis by FRV THAI SHUN, a 40 m LOA, 1 125 Bhp, stern trawler. Initially a 63-m headline, high-opening Engel balloon trawl was used as the sampling gear. Following the loss of this gear during the first quarter, however, a 29.3 m headline Granton trawl of the type described by Chilvers (1973) was used. Sampling followed the general pattern used in the 1972-73 surveys with each quarterly survey being conducted on a grid of preselected stations arranged along the four transect lines (A, B, C and D) used in 1972-73. Eight stations were fished on each transect (Fig. 1) and covered the following depth ranges: (1) 50-75 m, (2) 75-100 m, (3) 100-125 m, and as close as possible to the following depths: (4) 150 m, (5) 200 m, (6) 250 m, (7) 300 m, (8) 350-400 m. Stations 1 to 6 were comparable with stations 2 to 7

used in the 1972-73 surveys, while depths of less than 50 m, comparable to station 1 of 1972-73, were not fished due to restrictions on trawling in waters less than 40 m deep by the Chinese authorities. Stations 7 and 8 were at depths greater than those fished in 1972-73.

Three one-hour trawls per station were planned for stations 1 to 4, while, because of the greater time required to complete trawling operations in deeper waters (> 180 m), 2 hauls per station were planned for stations 5 to 8. Trawling generally followed this plan though occasionally hauls were not completed due to operational difficulties. Only data from successfully completed hauls, where the gear was undamaged or only sustained minor damage, were included in the analysis. The catches from each haul were sorted, identified, weighed and measured.

Results

Information relating to the fishing activities during each quarter are summarized in Table 1. Attempts to fish the deeper stations (180 m) on the D-line transect during the first quarterly survey resulted in the total loss of two sets of fishing gear, no further attempts were made to sample these stations and subsequently only stations D1 to D3 were fished on this transect. Problems were also encountered in fishing station C5 and this station was not fished after the first quarter. The data collected from stations D4 and C5, which were only sampled during the first quarter, have been omitted from all estimates of annual mean catch rates.

Table 1

Summary of the survey cruise data for January to October 1984

	Quarter			
	1	2	3	4
Date of first haul	14/1/84	11/4/84	11/7/84	14/9/84
Date of last haul	9/3/84	14/5/84	29/7/84	14/10/84
Date at sea	22	18	18	19
Days fishing	17	14	15	14
Total number of hauls	77	68	67	67
Total number of successful hauls	72	61	67	67

A preliminary analysis of the difference in fishing power of the Engel balloon trawl and the Granton trawl revealed that on average the Engel net captured four times as much by weight as the Granton. Consequently, the catch rates obtained by the Engel trawl have been divided by four to correct for this difference. The adjusted mean catch rates of all fish taxa for the survey period are presented in Table 2. The catch rates are very low ranging from 9.7 to 340.2 kg/h with an overall mean catch rate of 55.7 kg/h. The highest catch rate of 340.2 kg/h was exceptional and resulted from unusually large catches of *Cantherines* (Monocanthus) *modestus* at station B2 in the fourth quarter.

Noticeable differences were observed in the catch rates between seasons with catch rates in the third and fourth quarters tending to be higher than those in the first two quarters. In general catch rates at the deeper stations (> 180 m) also tended to be higher than those from the shallower stations, particularly if the extremely large catches of *Cantherines modestus* at station B2 in the fourth quarter are excluded. The mean catch rate for stations 1 to 4 was estimated at 49.8 kg/h compared to 63.6 kg/h for stations 5 to 8. No consistent trend in catch rates with depth was observed however. This difference in catch rates over the two depth ranges will have produced a minor bias in the overall mean catch rate of 55.7 kg/h due to the lesser number of deep water stations. No consistent trends in catch rates across the shelf were observed.

Table 2

The adjusted mean catch rate (kg/h) of all fish taxa at each station in 1984

Station	Quarter				Mean
	1	2	3	4	
A 1	24.3	23.6	100.5	84.4	58.2
2	9.7	16.7	52.3	48.3	31.8
3	33.7	25.5	81.2	56.8	49.3
4	14.3	29.2	84.6	64.2	48.1
5	14.9	57.2	37.0	35.4	36.2
6	10.7	28.0	67.3	68.2	43.5
7	19.3	16.0	66.7	175.6	69.4
8	19.6	25.1	87.3	123.1	63.8
Mean	18.3	27.7	72.1	82.0	50.0
B 1	18.1	62.5	51.9	54.0	46.6
2	14.6	27.8	51.6	340.2	108.5
3	18.2	45.9	46.6	60.4	42.7
4	15.4	81.0	61.2	98.8	64.1
5	70.2	61.1	49.4	82.9	65.9
6	66.5	65.3	104.1	85.2	80.3
7	25.5	91.8	53.6	66.7	59.4
8	22.3	123.6	57.6	162.2	91.4
Mean	31.3	69.9	59.5	118.8	69.9
C 1	33.2	23.4	26.7	29.2	28.1
2	51.8	44.9	40.7	72.0	52.3
3	41.5	49.8	58.5	53.0	50.7
4	48.4	56.1	38.0	121.0	65.9
5	16.9	-	-	-	-
6	20.9	30.7	151.9	114.8	79.6
7	71.3	68.2	46.8	113.2	74.9
8	30.9	25.9	44.1	88.0	47.2
Mean	39.4	42.7	58.1	84.4	57.0 a/
D 1	10.0	16.7	35.0	23.5	21.3
2	18.4	46.1	36.2	59.4	40.0
3	38.2	48.4	31.8	46.8	41.3
4	42.2	-	-	-	-
Mean	27.2	37.1	34.3	43.2	34.2 b/

a/ Excludes data from C5 in first quarter
b/ Excludes data from D4 in first quarter

The mean catch rates of commercially acceptable fish at each station are shown in Table 3. The taxa considered to be commercially acceptable are based on the taxonomic categories used by the Fish Marketing Organisation, Hong Kong, to record landings, together with other less common species known to be commercially acceptable and generally included in FMO statistics as "mixed fish". Catch rates of commercially acceptable fish ranged from 0 to 325.5 kg/h, with an average of 22.8 kg/h. The distribution of catch rates with depth differed markedly from that observed for all taxa with catch rates from the shallower stations (< 180 m) being much greater than those from the deeper stations. The proportion of commercailly acceptable species showed a slight tendency to decrease with depth down to 180 m, from around 80 % commercially acceptable at stations 1 and 2 to around 50 % at station 4. The proportion then decreased sharply to generally less than 8 % at stations 5 to 8 (Table 3). This marked change in composition of the catches occurred at around the same depth (~180 m) as the observed change in total fish catch. The seasonal distribution of catches of commercially acceptable fish was similar to that observed for all taxa with the highest catch rates in the third and fourth quarters. The proportion of commercially acceptable species at the shallower stations (< 180 m) was also higher in the third and fourth quarters (Fig. 2) with the dominant species being mostly commercially acceptable species. The dominant species differed markedly between the shallow and deep stations as would be expected (Fig. 2) and also tended to vary with season. *Nemipterus bathybius* was a dominant species in the shallower water catches in all seasons while *Cantherines modestus* and *Caranx equula* were dominant in three out of four quarters. At the deeper stations catches were dominated by non-commercial species notably *Malakichthys griseus*, *Urotygon mundus* and *Chlorophthalmus albatrossis* (Fig. 2).

In order to facilitate comparison with earlier reports on the demersal resources of the northern shelf the standing stock has been estimated by means of the "swept area" method used by Shindo (1973) and Aoyama (1973) where,

$$\text{Standing stock} = (CR \times A)/(a \times E \times 10^{3}) \text{ tons}$$

and CR = catch rate in kg/h, A = area of the shelf, a = area swept by the trawl and E is the escapement factor which was taken as 0.5. The swept area $a = d \times s \times 1.85 \times 10^{-3}$ km^2 where d is the horizontal opening of the trawl net (taken as two thirds of the headline) and s is the speed of the vessel in knots.

The overall mean catch rate of 55.7 kg/h was used to estimate the standing stock since no consistent differences in catch rate were observed across the shelf while the variation in annual mean catch rates was considered to be small with most values near the mean of 55.7 kg/h. The shelf area from 50 to 500 m was taken as $222{,}500$ km^2 after Aoyama (1973). On this basis the standing stock was estimated as 114.4×10^{3} tons.

Discussion

Mean catch rates in the 1984 survey were extremely low and much lower than those obtained during the 1972/73 survey. Although the two surveys were conducted by different vessels the gear used was standardized and comparative trawling exercises with the two vessels revealed no significant differences in total catch by weight at depths greater than 50 m (Richards, unpublished data). Consequently, the catch rates from the two surveys may be directly compared. The mean catch rates for all fish from comparable stations fished on the two surveys are summarized in Table 4. The overall mean catch rate in 1984 was 35 % lower than in 1973/74 and mean catch rates were lower for all depth zones fished (from 5 to 250 m), with the exception of station 5 where they were comparable. The decrease in-catch rates at stations 1 to 4 (50 to 150 m) probably reflects the increasing level of exploitation at these depths by the commercial fishing fleets. The lower catch rates at the deeper stations (> 180 m) are not so readily explained as these depths are beyond the normal range of operation of the commercial vessels. However, if the fish stocks in the deeper waters are dependent on recruitment from the shallower waters, increased fishing pressure in the shallower waters may have affected the deeper water stocks. It is noticeable that the proportion of edible fish in the catches at station 6 (~250 m) was only around 7% of the total compared with around 17% recorded in 1972-73 from this depth. The decline in overall catch rate of 35% compares well with the decline in catch per unit effort by the commercial trawler fleet of 40% over the eight year period 1975-83 reported by Lee and Chong (1984).

Table 3

The adjusted mean catch rate of commercially acceptable fish taxa at each station in 1984

Station	Quarter				Mean	as % of total
	1	2	3	4		
A 1	23.1	19.0	97.1	79.8	54.7	94.0
2	8.1	10.0	37.1	32.7	22.0	69.2
3	28.6	15.4	67.0	46.0	39.3	79.7
4	12.4	12.6	26.6	44.7	24.1	50.1
5	12.9	7.4	1.3	3.0	6.2	17.1
6	2.3	1.8	8.6	0.7	3.4	7.8
7	1.3	0.0	0.3	0.3	0.5	0.7
8	0.7	4.0	4.6	1.3	2.6	4.1
Mean	11.2	8.8	30.3	26.1	19.1	38.2
B 1	18.1	53.1	40.2	45.8	39.3	84.3
2	10.6	17.5	39.2	325.5	98.2	90.5
3	13.5	37.7	30.9	49.8	33.0	77.3
4	13.4	18.1	22.0	72.3	31.5	49.1
5	59.0	17.7	18.5	21.0	29.0	44.0
6	1.3	13.3	1.9	5.9	5.6	7.0
7	4.9	9.5	0.3	3.5	4.6	7.7
8	3.6	7.9	3.5	1.6	4.2	4.6
Mean	15.6	21.9	19.6	65.7	30.6	43.8
C 1	19.5	18.0	25.5	24.9	22.0	78.3
2	23.0	26.8	28.8	56.7	33.8	64.6
3	27.6	13.6	45.7	35.8	30.7	60.5
4	30.5	14.5	28.9	86.1	40.0	60.7
5	3.9	-	-	-	-	-
6	2.5	3.1	5.2	10.2	5.2	6.5
7	15.0	0.5	1.5	1.5	4.7	6.3
8	8.1	0.5	0.8	0.9	2.6	5.5
Mean	16.2	11.0	19.5	30.9	19.9[a/]	34.9
D 1	8.5	8.6	22.1	16.4	13.9	65.3
2	15.8	28.7	22.1	43.2	27.5	68.7
3	28.0	16.5	18.1	26.2	22.2	53.7
4	16.1	-	-	-	-	-
Mean	17.1	17.9	20.8	28.6	21.2[b/]	62.0

a/ Excludes data from C5 in first quarter
b/ Excludes data from D4 in first quarter

Shindo (1973) estimated the post-war (1956) stock size on the northern shelf at 560 000 tons (Table 5) and considered that this was near the optimum level, the stock size at that time being approximately half of the estimated maximum. Aoyama (1973) updated the estimate of stock size, by including data form 1960-73, to 405 000 tons 250 000 tons of which was in waters of greater than 50 m depth. The estimated stock size for waters of greater than 50 m was slightly greater than the estimated optimum of 222 000 tons which, following Gulland (1983), was again taken as half of the estimated maximum. An estimate of 159 000 tons for the stock size on the northern shelf in 1972/73 for waters of greater than 50 m depth can also be made using data from Chilvers (1973). This is considerably lower than the optimum level estimated by Aoyama and indicates that the stock was already overexploited. The estimated stock size had further declined to 114 000 tons by 1984 suggesting that the stock is severely over-fished. This is in contrast to the tentative conclusion of Lee and Chong (1984), from an analysis of commercial catch and effort data, taht the resource is currently fished at a level only just above the maximum yield point on the equivalent yield curve.

Estimates of stock size and level of exploitation based on the "swept area" method assume that the area sampled is a random sample of the total area inhabited by the stock and that the trawl catches some known proportion of the fish in its path. The assumptions are probably not too well justified (Gulland, 1983) and consequently only approximate values of stock size can be made in this way. They do, however, provide a useful check on estimates made using other stock assessment techniques. The difficulties in utilizing currently available data on commercial catch and effort for assessment of the stocks on the northern shelf were outlined by Lee and Chong (1984), while the theoretical bases for using surplus production models for the assessment of tropical multispecies stocks has also been questioned by Pauly (1979). Present estimates of the stock size and level of exploitation of the demersal resources on the northern shelf are therefore, at best, only an approximate indication of the state of the stocks.

In his review of the theory and management of tropical multispecies stocks, Pauly (1979) has questioned the models currently in use in the region and has emphasized the need for more and better biological and statistical data on the stocks in question. This is clearly the case for the demersal resources on the northern shelf and future research should be aimed at improving the data base and providing information for rational development of the fisheries.

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Table 4

The mean catch rates of all fish taxa at each station in 1972/73 and 1984 (Data for 1972/73 extracted from Chilvers (1973)

	1972/73					1984				
Station	A	B	C	D	Mean	A	B	C	D	Mean
1	42.3	45.6	35.3	42.6	41.4	58.2	46.6	28.1	21.3	38.6
2	123.0	28.7	49.2	63.0	73.5	31.8	108.6	52.3	40.0	58.2
3	140.4	44.4	61.9	84.7	72.9	49.3	42.7	50.7	41.3	46.0
4	54.2	91.1	32.0	-	59.1	48.1	64.1	65.9	-	59.3
5	120.2	102.8	-	-	111.5	36.2	65.9	-	-	51.0
6	121.5	198.5	143.3	-	154.4	43.5	80.5	79.6	-	67.8
Mean	100.2	85.2	64.3	63.4	81.2	44.5	68.0	55.3	34.2	52.7

NB: Station 1 is station 2 of Chilvers (1973), etc.

Table 5

Estimated demersal stock size of the northern shelf of South China Sea

Authority	Period/ Year	Estimated stock size (in '000 t) 0-50	50-500	Total	Optimum stock size[a/] (in '000 t) 0-50	50-500	Total
Shindo (1973)	1931-38	-	-	1 006	-	-	560
Shindo (1973)	1956	-	-	560	-	-	(560)
Aoyama	1950-73	155	250	405	310	222	532
Present study, data from Chilvers (1973)	1973	-	159	-	(310)	(222)	(532)
Present study (1985)	1984	-	114	-	(310)	(222)	(532)

a/ Optimum stock size taken as 50% of maximum stock size. Numbers in parenthesis represent assumed values

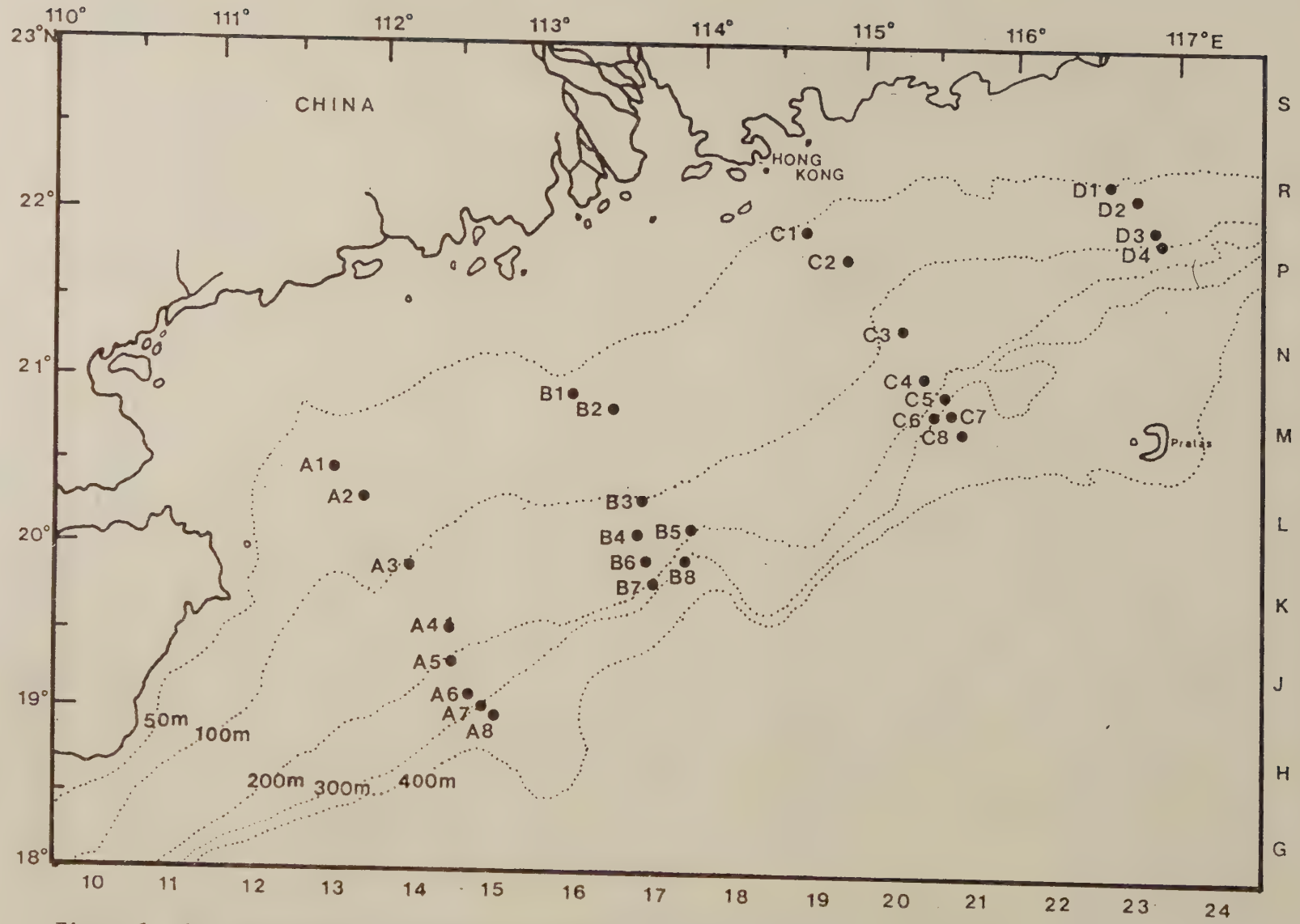

Figure 1 The mean position of the bottom trawl stations fished during the 1984 survey of the northern shelf.

Figure 2 Proportion of the total catch by weight of commercially acceptable (shaded) and non-commercial species (non-shaded) in each quarter for the shallow (< 180 m) and deep stations (> 180 m) and the dominant species present in the catches (*A.*= *Alutera monoceros*, *A.* = *Amblyrhynchotes spinosissimus*, *C.*= *Caranx equula*, *C.*= *Cantherines modestus*, *C.* = *Chlorophthalmus albatrossis*, *C.* = *Chimaera phantasma*, *C.* = *Cubiceps squamiceps*, *L.* = *Lophiomus setigerus*, *M.* = *Malakichthys griseus*, *N.* = *Nemipterus bathybius*, *P.*= *Priacanthus tayenus*, *P.* = *Psenes indicus*, *P.* = *Psenopsis anomala*, *R.* = *Raja hollandi*, *S.* = *Saurida tumbil*, *S.* = *Squatina nebulosa*, *S.* = *Satyrichthys rieffeli*, *T.*= *Trachinocephalus myops*, *T.* = *Trachurus japonicus*, *U.* = *Urotygon mundus*, *Z.* = *Zenion japonicum*)

ANNEX 7b

Country Report - Indonesia

Research Activities in Indonesia

INTRODUCTION

Indonesia is an archipelagic State which is located between two large oceans, the Pacific and Indian Oceans. It has some close neighbouring countries, such as Thailand, Malaysia and Singapore in the Northwest, Kampuchea, Viet Nam and Brunei bordering to South China Sea in the North, Philippines in the Northeast Papua New Guinea in the East and Australia in the Southeast.

Territorial waters of Indonesia represent some 70 % of the land, which is estimated to be about 3.1 million km^2. After the declaration of the Indonesian Exclusive Economic Zone in 1980, the jurisdictional waters of Indonesia have been about 5.8 million km^2. In these huge marine waters of Indonesia there are possibilities that some stocks be shared with the neighbouring countries.

The total production of marine fisheries in Indonesia since 1976 until 1982 had increased by about 5.45 % a year, from 1 081 589 t in 1967 to 1 490 719 t in 1982. In 1981 the total production of marine fisheries decreased by about 12.3 % due to the complete ban of trawling by the Government, but in 1982 it increased again.

1. RESEARCH ACTIVITIES

1.1 Research Mandates

Fisheries research activities in Indonesia have been still left behind when it is compared to agricultural research. Research Institute for Marine Fisheries with its four sub-institutes is responsible for the research in Indonesia covering the huge waters mentioned above.

The mandates of the Research Institute for Marine Fisheries are to provide data and information to the fishermen, fishing industries and the Government through a Directorate General of Fisheries about:

(1) What resources are exploitable

(2) Where they are located

(3) When they are available

(4) How they can be caught, and

(5) What amount can be taken annually on a sustainable basis

Research on socio-economics is also carried out to support field activities for the development of the fisheries. In order to achieve these mandates, several steps are taken:

(a) Establishment of working disciplines, which associates with the existing research groups, i.e.:

1. Fisheries resources, comprising the sub-groups:

Tuna and skipjack;

Small pelagic fish;

Demersal fish; and

Shrimps and other crustaceans

2. Environmental conditions

3. Fishing technology (gears and crafts)

4. Post-harvest technology

5. Socio-economics

(b) Cooperation with the Directorate General of Fisheries (DGF) and collaboration with the Directorate for Living Resources Management in preparing the development programme which is issued by the Directorate General of Fisheries;

(c) Communication and collaboration with the direct users and fishermen to identify technological needs and requirements; and

(d) Communication directly with fishermen's organization in order to acquire the knowledge on the needs and requirements in fishing community.

Research programmes are primarily prepared by each of the research groups mentioned above and then approved by the Director of the institute.

1.2 Collaboration with other Institutions

Collaboration is also being made with other institutions which include:

(a) ORSTOM (France)

This collaboration was started in 1984, mainly on investigation of small pelagic fisheries.

(b) Bay of Bengal Programme (FAO, UNDP and Government Cooperative Programme, BOBP)

Since 1983, Indonesia has become a member of BOBP. The Programme coordinates, as a part of its functions, the research activities conducted by the three countries concerned in the Malacca Strait: Indonesia, Malaysia and Thailand.

(c) Indo-Pacific Tuna Programme (FAO/UNDP, IPTP)

It was started in 1983, and has been carrying out the taggings for skipjack and tunas in the eastern Indonesian waters.

2. DISSEMINATION OF RESEARCH RESULTS

The main user of research results is the Directorate General of Fisheries as the policy maker. The data are needed not only for the managing of fisheries, but also for the development purpose of the fisheries to identify the areas where surplus still exists for further intensified fishing (Figure 1).

The other important users are fishermen who are always keen on improving fishing and aquaculture techniques. Fishermen cannot use directly all the research results; the information should therefore be disseminated through fisheries extention services. Indonesian fisheries are dominated by small-scale fisheries (about 90%) and the fishermen involved are generally not well educated. In this connection, another important role of fisheries, namely, conservation of resources, should be played properly by the policies, because fisheries resources are not infinite.

Research results are also used by other scientific institutes such as Universities.

In brief, research results are disseminated through:

1. Scientific reports
2. Scientific meetings
3. Various displays at exhibitions
4. Meetings with the Directorate General of Fisheries
5. Meetings with fishermen's organizations
6. Meetings with fisheries extension service officers
7. Meetings with regional fisheries offices

The dissemination of research results is not so easy especially for the last three sectors mentioned above. Many meetings have been frequently held with the Directorate General of Fisheries but not on a regular basis.

3. RESEARCH PROGRAMMES FOR 1985/1986 FISCAL YEAR

As was mentioned earlier, the research programmes are prepared by each of the research groups and generally cover three to five years. These programmes are composed of several Research Operational Plans which are prepared every year, defining detailed research activities for each year. The magnitude and success of the research activities depend on three mostly important factors, namely:

(a) Money
(b) Manpower
(c) Materials/tools

The budget available for 1985/86 fiscal year does not look promising. The budget does not seem to be sufficient enough to cover all the above-mentioned areas. Manpower and materials are also very limited. The research activities will accordingly have to be very limited. For the next fiscal year, under these circumstances, the priority will be given to the selected important areas where fishermen concentrate such as Java Sea, Bali Strait and Malacca Strait (Figure 2).

For 1985/86 fiscal year nine research programmes have been prepared:

(a) Small pelagic fish in Java Sea and Bali Strait.

This will be conducted in collaboration with ORSTOM in the Java Sea and Bali Strait, and in collaboration with BOBP in the Malacca Strait.

(b) Demersal fish and shrimps in Java Sea and along the southern coast of Java

Two research programmes.

(c) Shrimp resources in Arafura Sea

(d) Squids along the southern coast of Java, Bali and Lombok Strait

(e) Marine environments along the northern coast of West Java

This includes the Thousand Islands and the North of Jakarta.

(f) Tunas and skipjack along the southern coast of Java and selected few other areas.

(g) Gears and crafts

Most activities will be done in the Java Sea, Kalimantan and Sumatra. The objective is to investigate alternate gears for trawl.

(h) Socio-economics

The research is concentrated in the cost and return analysis for a few selected gears being operated in the Java Sea. The magnitude of the perception by the fishermen about the transmigration programme of the Government is also surveyed and analysed.

4. RESEARCH CONSTRAINTS

(a) Difficulty in compiling reliable statistics:

Indonesia is dominated by small-scale fisheries, and the data are collected by regional fisheries offices. Statistical data used primarily for stock assessment depend largely on the accuracy of the data collected.

(b) Insufficient enforcement of management measures:

The success of the fisheries management not solely on the research results, but also on other factors, such as law enforcement

(c) Insufficient fundings and manpower:

The budget available and also the number of research scientists are very limited.

(d) Lack of expertise in some field:

Some research programmes are still weak, such as socio-economics, gears and crafts technology, which need to be improved by upgrading the scientist.

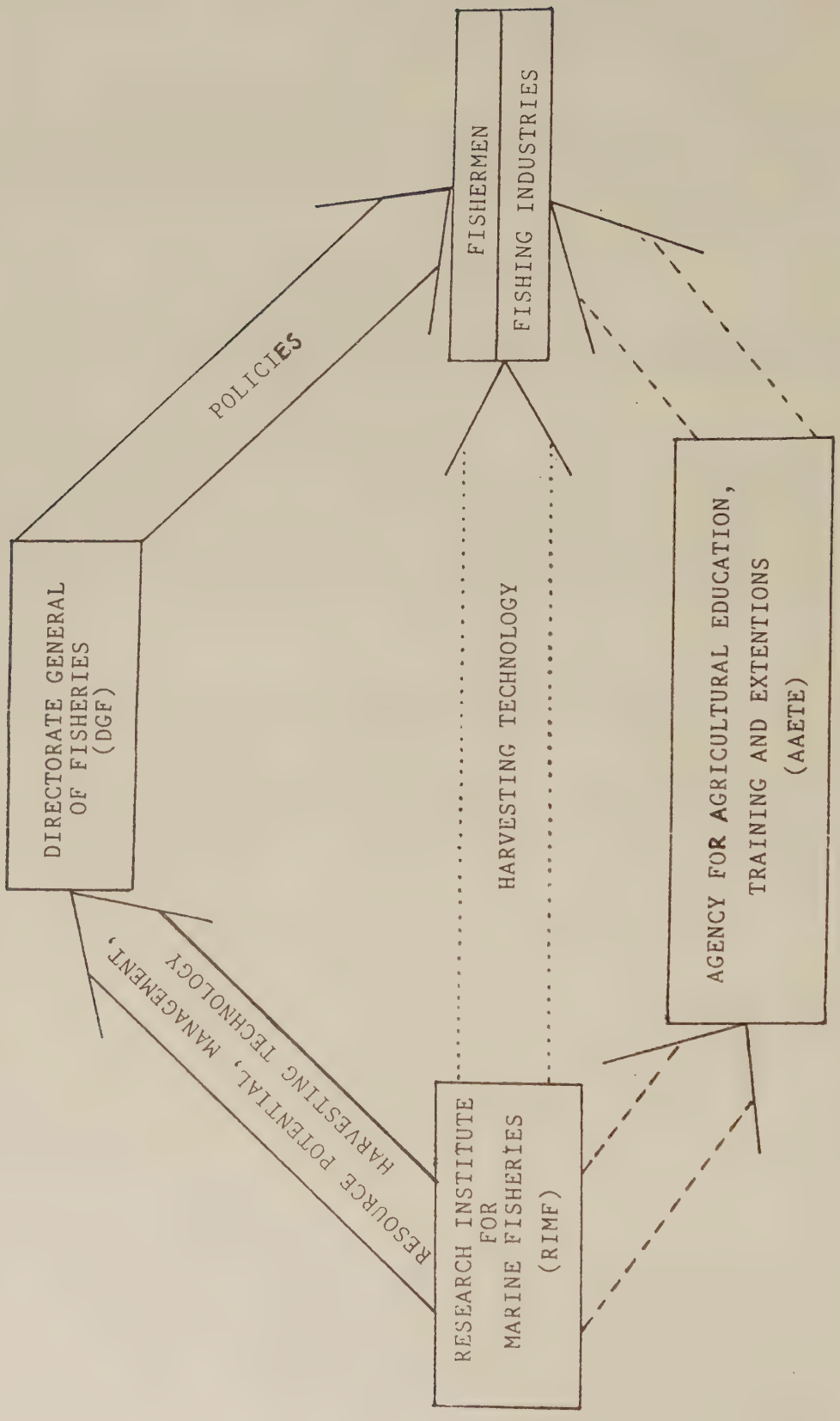

Figure 1 Dissemination process of research results to the users

Figure 2 Research areas for 1985/86

ANNEX 7c

Country Report - Malaysia

National Plans for Research and Fisheries Resources

1. INTRODUCTION

Commercial fish landings in Malaysia are derived from the catches by various fishing gears operating in coastal waters. Both demersal and pelagic fisheries resources are exploited by these fishing gears. The main fishing presently responsible for the bulk of marine fish landed, in order of importance, are:

(a) Trawl nets

(b) Seine nets

(c) Drift gillnets

Apart from the above, other less important fishing gears in operation include hooks and lines, bagnets, traps and lift nets.

1.1 Trawl fishery

The bulk of the demersal fish and prawn stocks are exploited by trawlers which operate otter trawls, the only type of trawl currently in use within the fishery. Trawlers contributed about 52% of the total marine fish and prawn landed in Peninsular Malaysia in 1981. There are at present some 6 000 trawl units estimated in operation in Peninsular Malaysia, the majority (67%) being small units of below 25 gross tons. Catches landed by the trawlers include a large number of demerdal fish species, none of which is individually abundant. Some of the most common families landed are the Nemipteridae, Sciaenidae and Cynoglossidae. In addition to these, the higher priced demersal fish species landed include those from the families Serranidae and Lutianidae.

Since the introduction of trawling to Peninsular Malaysia, some changes in the catch composition of demersal fish have been observed. The disappearance of *Lactarius lactarius* from trawl landings is one notable example. Of the Sciaenidae, *Otolithes ruber* which used to be an abundant species in the trawl landings has now decreased in quantity. The size of this fish caught by the commercial boats has also decreased. *Rastrelliger* which was caught mainly by purse seines prior to 1975 now contributes a high proportion in the trawl catch.

The landings of commercial trawlers also include a substantial amount of prawns. Approximately 50 percent of the total prawn landings in the country is attributed to the landings by trawlers.

1.2 Seine Fishery

The seine fishery ranks next in importance to the trawl fishery in the country. Various types of seines are employed in this fishery, the most important commercially being the purse-seines which accounted for about 19% of the total marine landings in Peninsular Malaysia in 1981. Currently, there are some 2 640 seine units in operation and the bulk of the pelagic stocks are fished mainly by these seines. However, purse-seines constitute only about 29% of the total seine units in operation although they contribute around 67% to the total seine landings.

Catches landed by the purse-seines include only a few pelagic fish species, the more abundant ones being *Rastrelliger* spp., *Stolephorus* spp., *Sardinella* spp. and *Megalaspis cordyla*.

1.3 Drift Gillnet Fishery

Currently there are some 10 113 gillnet units estimated in operation in Peninsular Malaysia, the most prominent among them being the drift gillnet which is the most extensively used throughout the country. While the number of gillnet units in operation is much higher than either trawlers or seines, they contributed only about 10% of the total marine landings in the country in 1981. The main fish species landed by the drift gillnets include *Scomberomorus* spp., *Rastrelliger* spp., *Euthynnus* spp./*Thunnus* spp. and *Chirocentrus dorab*.

Of the three major types of fisheries described above, only two types are of major concern to the national fisheries administrators viz. the trawl fishery and seine fishery (in particular, the purse-seine fishery) which exploit the bulk of the demersal and pelagic resources respectively. Consequently, advice is frequently sought by fisheries administrators on the potential and state of these resources for formulating policies for the development and management of the two fisheries.

Currently the principal agencies responsible for providing the above information and to conduct research on the resources is the Research Branch of the Fisheries Department. However, the Agricultural University of Malaysia also conducts some academic research on an *ad hoc* basis on selected marine fisheries topics.

2. CURRENT STATUS OF RESOURCE EXPLOITATION

2.1 Pelagic fish resource

The present landings (1981) from the waters off the West Coast of Peninsular Malaysia is 117 000 t, of which 45 000 t were landed by fish purse seines, 27 000 t by anchovy purse seines, 17 000 t by the trawlers and the balance of 28 000 t landed by various traditional gears.

The main pelagic species currently landed are:

Table 1

West Coast

Species	Landings ('000 m.t.) 1981	Estimated MSY ('000 m.t.)
Rastrelliger spp.	45	25
Decapterus spp.	8	10
Megalasps	4	10
Sardinella spp.	5	6
Small tunas	3	5
Stolephorus spp.	27	17
Others	50	15
Total	117	88

The MSY estimated for the total pelagic resource for the West Coast by the FAO/SCSP Workshop on the fisheries resources held in Jakarta in 1977 was 88 000 m.t. The individual MSY for the main pelagic species are as shown in Table 1. The 117 000 t landed on the

West Coast represents only the catch of the Malaysian fishing vessels. This does not include catches taken by foreign fishing vessels operating in this area. If the catches taken by foreign vessels are taken into consideration, the total catch taken from this area will far exceed the 117 000 t. This situation reflects a state of overexploitation of the pelagic resources on the West Coast. However, it has to be borne in mind that the MSY estimated was based on the Malaysian catch effort data prior to 1977. In the years subsequent to 1977 there has been heavy landings of pelagic species on the West Coast. As such, the MSY value stated above could be an underestimate. However, a more recent review of the MSY has not been made.

On the East Coast of Peninsular Malaysia the landings (1981) were 113 000 t of which fish purse seines landed 59 000 t, gillnets 15 000 t, lift nets 19 000 t and the balance landed by anchovy purse seines and various other traditional gears.

The main pelagic species currently landed are:

Table 2

East Coast

Species	Landings ('000 m.t.) 1981	Estimated MSY ('000 m.t.)
Rastrelliger spp.	35	15
Selaroides spp.	28	-
Decapterus spp.	16	15
Small tunas	15	-
Sardinella spp.	12	-
Stolephorus spp.	6	-
Others	28	-
Total	140	75

The MSY for pelagic resources was estimated by Pathansali (1976). The MSY for individual species was also estimated only for two species by Chong (1976). The 140 000 t landed on the East Coast in 1981 was a slight overestimation due to initial errors caused by the implementation of a new data collection system. The pelagic landings in 1980 was 79 000 t and therefore, the actual landing could be more around 80 000-90 000 t. These landings do not include catches taken by foreign vessels in the same area. Table 2 indicates an apparent situation of overexploitation . Bearing in mind that the MSY was estimated in 1976, and in the last nine years there has been a substantial increase in fishing activities on the East Coast, the MSY could be an underestimate and therefore has to be reviewed.

Information on the pelagic stocks and landings for Sabah and Sarawak is scanty. However, estimates based at various workshops indicate MSY for this area to be 183 000 t, whereas present landings in the region are 53 000 t (1978). This indicates a situation of underexploitation of this stock in this area.

2.2 Demersal Fish Resource

Current demersal fish landings on the West Coast is estimated at 173 000 t (1981). The MSY estimated for the West Coast is 160 000 t at the FAO/SCSP Workshop in Jakarta (1974). A large number of species contribute toward demersal landings but none of these are individually dominant. Some of the more common families are Sciaenidae, Cynoglossidae, Nemiptheridae, Mullidae, Tachysuridae and Synodontidae. The bulk of the demersal landing on West Coast are harvested by the otter trawls and to a smaller extent by the bagnets.

The above figures indicate that the exploitation of the demersal resources of West Coast has surpassed the level of optimal exploitation.

The landings of the demersal fish of the East Coast of Peninsular Malaysia is about 57 000 t (1981). The composition of the demersal catch is made up of a large number of species none of which are dominant. The common families of demersal species landed are more or less similar to that of the West Coast. The bulk of the demersal catch is harvested by the otter trawls, hooks and lines and traps. The estimated MSY for the East Coast at FAO/SCSP Workshop on demersal resources in 1977 was 200 000 t. However, following a refinement of the above Workshop's findings by the Fisheries Research Institute, Malaysia arrived at the potential yield of 175 000 t. But a recent review by an FAO Consultant (A. Simpson) in 1984 was 168 000 t. It is more likely that the estimated MSY for the East Coast is between 168 000-175 000 t for the area within 60 n miles from the coastline. The estimated MSY of 168 000-175 000 t compared with the current landings of 57 000 t indicates a state of underexploitation. However, if the estimated 25 000 t of catch taken by foreign fishing vessels is taken into consideration, the actual potential available for optimal exploitation is only between 86 000 t to 93 000 t in the above area. The exploitation of the balance is however limited by the commercial viability of the species available.

2.3 Shrimps/Prawns Resource

The prawn landings on the West Coast in 1981 was 45 000 t. More than half of these landings were by trawlers and the remainder being landed by the bag nets, seine nets and gillnets. The composition of the prawns landed consist of several species, the more common ones being *Metapenaeus affinis*, *M. brevicornis*, *M. lysianassa*, *Parapenaeopsis coromendelica*, *Parapenaeopsis harwickii*, *Penaeus merguiensis* and *Penaeus monodon*. The most important genus commercially is *Metapenaeus* due to its abundant occurrence in commercial catches, while the genus *Penaeus*, although not as abundant, commands a high price by virtue of the quality of the meat and its large size.

The MSY for prawns on the West Coast was estimated at around 53 000 t by the Workshop on the Fisheries Resource in the Malacca Straits 1976. Prawn landings reached the point of maximum production in 1978 when landings were recorded at 63 000 t. Subsequent to 1978, prawn landings have slightly declined to 45 000 in 1981. Evidence of the trend indicated that the current level of exploitation of prawns has already exceeded the optimal level.

On the East Coast total landings of prawns in 1981 were 4 000 t, landed mainly by trawlers. Unlike prawns on the West Coast which are available throughout the year, prawns on the East Coast are seasonal, being more abundant during the monsoon season. The species composition of prawns on the East Coast is quite similar to that of the West Coast. The MSY for prawns is estimated aroung 5 000 t (Pathansali, 1976). Unlike the prawn resource of the West Coast, it is suspected that the prawn resource on the East Coast is "semi-residential"; however, it is yet to be confirmed. Based on the current landings, the exploitation of prawns on the East Coast is almost at its optimum level of exploitation.

2.4 Cephalopods Resource

Landings of cephalopods on the West Coast in 1981 were 9 000 t. The bulk of these were landed by trawlers. Several species of the *Loligo* are landed; however, very little taxonomic work had been done to identify the species composition. Similarly, the cuttlefish landings are mainly of the Sepia family, but like the *Loligo* little taxonomic work had been done on this too. Squids/cuttlefish landings are seasonal and estimates are yet to be made to determine the MSY. However, preliminary estimate indicate the MSY for squids/cuttlefish could be in the region of 11 000 t.

Landings of cephalopods on the East Coast were around 6 000 t in 1981. The bulk of the catches are landed by trawlers while the remainder are caught by jigging and purse seines. The composition of cephalopods are of the *Loligo* and *Sepia* species and some toxonomic work is currently being carried out by the Fishery Department and the Agricultural University of Malaysia. The estimated MSY for squids/cuttlefish is around 4 000 t. However, current development in the fishery indicates that this estimate of the MSY could be an underestimate and has to be reviewed.

3. CURRENT RESEARCH PROGRAMMES

The current research programmes are being conducted to monitor the status of fisheries resources in the inshore water and to study the effect of various management measures on the resource. Under the programme to monitor the status of the resource, annual surveys are being carried out to study the changes in the abundance and species composition on the various resources. To supplement the above commercial catch/effort data are being simultaneously collected and analised.

As for the programmes to monitor the effects of management measures on the resources, a number of studies have been done, such as studies on the effect of the mesh size regulation on trawlers, the efficiency of the By-catch excluder device (B.E.D.) on trawlers as well as the mesh size selectivity for bag nets.

In terms of the pelagic resources, very little has been done so far to assess the pelagic stocks. However, it is planned to use acoustic methods to estimate the pelagic resources.

The programmes planned for the immediate future include the use of additional techniques, besides the existing traditional stock assessment models to assess the resource, such as the length-structured dynamic models. Besides the above other programmes to be undertaken are to intensify biological studies on selected species, species composition of trash fish, gear selectivity and efficiency studies, the effects of artificial reefs and seasonality and distribution of selected species in the inshore waters.

As for the offshore waters it is planned to carry out a survey to assess the resources beyond 60 n miles using both the swept area and acoustic methods of assessment.

4. CONSTRAINTS

A major constraint in implementation of the various research programmes as outlined is the lack of adequate funding. In addition, appropriate expertise in various fields is currently not easily available.

ANNEX 7d

Country Report - Philippines

National Plans for Research on Fishery Resources

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Salud R. Ganaden,
and
Ma. Ethel G. Llana

1. INTRODUCTION

The Philippines is an archipelagic country which is situated in the outer rim of the Western Pacific between latitudes 21°25'N and 4°23'N and longitudes 116°00'E and 127°00'E. It is one country in Southeast Asia which has an extensive water area compared to its land area and therefore depends largely on the resources it exploits from its vast area of marine and inland waters.

The Philippines marine waters originally comprised a total area of some 6 600 000 ha. With the declaration of the 200-mile exclusive economic zone (EEZ) under Presidential Decree No. 1599, this area has expanded toward the China Sea and the Pacific Ocean by some 50 600 000 ha. Inland waters, on the other hand, comprise a total area of some 24 000 ha of lakes, rivers and reservoirs, excluding an aggregate area of 208 000 ha of developed fishponds.

The country's marine interest focus on the fishery resources of the EEZ and the indigenous offshore sources of energy as well as shipping and mineral resources. All these resources need to be explored and exploited, managed and conserved as clearly defined in the sovereign rights embodied in the EEZ declaration.

Beyond the wealth of the EEZ waters lies of course the importance of the municipal fisheries which comprised 56.20% of the country's fish production in 1982. Of the municipal fisheries production, 72.37% was attributed to the marine fisheries while 27.63% came from the inland fisheries. Of the total fish production in 1982, commercial fisheries contributed 25.10%, while aquaculture made up only 18.70 %. These figures from latest fisheries statistics indicate the important role of marine fisheries in the overall fishing industry. Yet, paradoxically, it is in marine fisheries where support for research and development has not been extended fully compared to aquaculture.

Tracing the history of Philippine fish production to four years back from 1982, it will be noted as shown in the following five-year production table that fish production has increased gradually from year to year. Obviously, despite the corresponding growth in human population, the fishing industry has been responsive by keeping pace with the increasing demand for fish.

Table 1

Summary of the Philippine fish production (in metric tons), 1978-82.
(Data from the Fisheries Statistics of the Philippines, Vol. 32, 1982.)

Year	Commercial	Municipal		Aquaculture	Total
		Marine	Inland		
1978	505 840	686 890	171 019	216 655	1 580 404
1979	500 747	635 538	203 820	241 198	1 581 303
1980	488 478	647 284	247 326	289 166	1 672 254
1981	494 768	709 989	228 639	339 501	1 772 897
1982	526 273	708 016	270 346	392 348	1 896 983

Exports of fish and fishery products totalled to some 84 M kg valued at approximately ₱ 1.2B in 1981, and only about 68 M kg at ₱ 1.1B in 1982. These figures, notwithstanding the value derived from the local fisheries trade, demonstrate the level of importance the fishing industry occupies in the country's economic system.

Overall, despite some problems that beset the fishing industry such as declining yield of traditionally fished areas, inadequate marketing and distribution system and facilities, inadequate trained research manpower, etc., fisheries still remain one of the most important industries of the country with such leading commodities as tuna, shrimps, seaweeds, and shellcraft products in the export trade.

The significance of fisheries to the country's total economic development is further underscored by the concern given to fisheries research by the Government as well as some private institutions. Research into problems concerning the fishing industry grew quite naturally out of scientific research on fishery resources.

2. NATIONAL FISHERY RESOURCES RESEARCH PLANS

The conduct of fisheries research in the Philippines is based on the following research thrusts: food and nutrition, conservation and management, and import substitution. The thrusts serve as the reference points from which fisheries research plans are designed and implemented.

There are three disciplines under which research areas have been identified, namely: marine fisheries, aquaculture and inland waters. For the first two disciplines, the research areas have been prioritized by commodity, and for inland waters by area (i.e., lakes, reservoirs, swamps and rivers).

The first priority area in aquaculture is broodstock development of finfishes and/or screening of cultivable species of crustaceans, mulluscs and seaweeds. In marine fisheries, priority has been placed on resource/stock assessment including biology and ecology of species; in inland waters, on physical inventory and also on research assessment.

In the following discussion, emphasis is placed on research plans on marine fishery resources to be relevant with the theme of this Workshop on Shared Stocks.

The agencies/institutions participating in the national programme on marine fishery resources are the Bureau of Fisheries and Aquatic Resources (BFAR), U.P. in the Visayas College of Fisheries and Institute of Fisheries Development and Research (UPVCF and UPVIFDR), the University of the Philippines Marine Sciences Centre (UPMSC), Mindanao State University Institute of Fisheries Research and Development (MSU-IFRD), Bicol University College of Fisheries (BUCF), Silliman University (SU), University of San Carlos (USC), National Museum (NM), Don Mariano Marcos Memorial State University (DMMMSU), Mariano Marcos

State University (MMSU), Mindanao Regional School of Fisheries (MRSF), and the Philippine Federation of Fishing Associations (PFFA) - with the Philippine Council for Agriculture and Resources Research and Development (PCARRD) as the overall research coordinator. Financial support for the implementation of marine fishery researches comes from local as well as international funding institutions.

The national fisheries research plans are designed with reference to the Integrated Fisheries Development Programme which was developed as a consequence of Presidential Decree No. 704 known as the Fisheries Decree of 1975.

Under this national programme is the Expanded Fish Production Programme which BFAR implements in support of the Government's policy to "accelerate and promote the integrated development of the fishery industry and to keep the fishery resources of the country in optimum productive condition through proper conservation and protection".

3. IMMEDIATE PLANS

(a) Expansion and strengthening of the country's regional resources assessment project through the establishment of additional sampling areas in the traditional fishing grounds of each region.

This activity is being done to obtain better and more accurate information on the state of the marine resources of the coutnry.

(b) Extension of the present Tuna Research Project to the other regions of the country.

Presently, sampling for biological studies and monitoring of the tuna resources are only being undertaken in the Mindanao areas. These activities will be extended to the other fishing areas, preferably where the tunas are reportedly caught, to be able to determine the state of the tuna resource and its potential for development.

(c) Continuation of the Fishery Oceanographic Investigation of Traditional and Non-traditional Fishing Grounds (including the EEZ).

Acoustic surveys; physico-chemical, fish eggs and larval studies; and experimental fishing are undertaken under this project to monitor changes in the environment which would affect the productivity of these fishing areas.

(d) Biological studies of important marine fish species.

Growth rate, size distribution, spawning, fecundity, and gut content studies are continuously done to provide the biological information needed for the stock assessment work.

(e) Continuous evaluation, monitoring and improvement of fishing gear.

Under this plan, activities such as mesh-size selectivity studies, modification of existing gear, etc., are being carried out to determine their effectivity and efficiency in terms of exploiting the resources.

(f) Improvement of post-harvest/handling technology.

Studies such as the use of different ice-fish ratios and different types of container for packing are being continued.

(g) Utilization of trashfish.

Studies on the preparation of convenient food items from trashfish are presently carried out.

4. LONG-RANGE PROGRAMMES

Future research plans on marine fishery resources include the implementation of the Fish Stock Assessment Component of the Rainfed Resources Development Project (RRDP) which

is assisted financially by the U.S. Agency for International Development (USAID), Tuna and Skipjack Tagging in collaboration with the Indo-Pacific Tuna Development and Management Programme (IPTP), ASEAN-Australia Agreement on Coastal Zone Management, as well as the ASEAN-Canada Agreement on Marine Living Resources Development and Management and Pollution Monitoring.

(a) RRDP Fish Stock Assessment Component

The ultimate goal of the Fish Stock Assessment Component is to provide scientific bases for developing management schemes which would maximize the utilization of coastal fisheries resources while at the same time maintaining sustainable economic yields leading to the upliftment of the quality of life of the fishermen.

The implementation of this RRDP Component is on a regional level, with the BFAR Central Office as the lead implementor. Three regions (Regions 5, 6 and 8) have been selected on the basis of their immediate needs for fisheries development. Depending upon the success of the whole project, the Fish Stock Assessment Component Activity may be extended to the other regions of the country.

Within the scope of the Component's plan are the specific objectives of determining the state of the marine resources in the three regions, and establishing important information on biological features of resources such as spawning, mortality rate, stock abundance, etc.

Planned activities for the Fish Stock Assessment Component include resource surveys of the fishing areas in the three regions, biological studies of important species, evaluation of municipal fisheries data, oceanographic investigations, as well as socio-economic studies to come up with a general profile of the coastal fishery industry in the three regions.

In-depth analysis of the data obtained will be done and management schemes shall be developed accordingly to maintain productive yield levels of the resources and to improve the quality of life of the fishing families.

(b) Tuna and Skipjack Tagging

In collaboration with the IPTP, tuna and skipjack tagging will be started in 1986 to determine whether the Philippine tuna being exploited are local stocks or part of the major stocks inhabiting the Western Pacific. Information on their migration, blood protein and biological habits are needed inputs to this project.

(c) ASEAN-Australia Agreement on Coastal Zone Management

The main goal of the project is to generate relevant management information in coastal ecosystems particularly the mangrove and coral reef areas, and to use these information in developing coastal zone management policies that will be both beneficial to the country in particular and the Southeast Asian region in general.

Initially, selected senior project personnel will participate in a training/workshop on field procedures for community structure and material budget studies in coral reef, nearshore, and mangrove environments; data handling techniques; and system modelling approaches, and establish procedures to be able to obtain comparable data bases among ASEAN countries.

Field research activities to be undertaken on selected sites include community studies, inventory of resource distribution using satellite enhanced imagery techniques, productivity nutrient influxes, pollution monitoring, etc.

The lead agency is the National Science and Technology Authority with several research institutions working on the various aspects of the project in close collaboration with one another.

This project is envisioned for implementation for a period of five years and could be expanded to cover larger areas depending upon the success of this cooperative endeavour.

(d) ASEAN-Canada Agreement on Marine Living Resources Development and Management and Pollution Monitoring

Under the Agreement, one of the proposed programmes of the Philippines which is relevant to the fishery resources is the research on shared stocks of migratory pelagic species other than tuna to be carried out in the Southern Philippines for a period of three years. The main objective of this research programme is to assess the present status of the pelagic fish resources with a view to implementing a fisheries management scheme which will provide for the rational exploitation of small migratory pelagic species and allocation of benefits from such shared stocks among ASEAN-member nations.

The BFAR Central Office will lead in the implementation of the project with cooperators from Regions 4, 9, 11 and 12, and the Philippine Coast Guard.

The general activities include biological and oceanographic investigation and experimental fishing.

5. RESEARCH NEEDS

In order to effectively carry out these planned research programmes, there is an immediate need to strengthen the manpower research capability. Such need can be realized with adequate financial and administrative support for research. This support could come mainly from the Government and partially from foreign institutions willing to assist in coming up with a more valuable and effective research manpower development programme.

ANNEX 7e

Country Report - Thailand

National Plan for Future Research in Thailand

1. INTRODUCTION

The marine fishery in Thailand was rapidly developed during 1960s to 1970s, being supported by the introduction and extension of various new fishing technologies, amongst which the introduction of trawl fishing in the early 1960s and the development of luring purse seine since 1973 are highlighted. This resulted in a remarkable increase in marine fish landing of the country during this period, reaching a peak of 2 190 000 t in 1977 which was approximately ten folds of that in the early 1960s. The large increase in marine fish landing thus realized, contributed substantially to the country not only for the domestic food supply but also for the foreign currency earning through the export of the fish and fishery products.

Such remarkable development was made during the last three decades. However, the trend on the total fish production shows a sign of decline after its peak in 1977. The recent marine fisheries production still remains at a high level of about 1.8 million t, which accounts for about 90% of the total fishery production of the country.

The rapid expansion of the marine fishery, as mentioned above, had affected a great deal the resources of both pelagic and demersal fish in the territorial waters. Many stocks of pelagic fish have been fully exploited which include mackerels (Indo-Pacific and Indian mackerels), scads, sardines and anchovies. Coastal tunas, Spanish mackerel, hardtail scads and trevallies are among pelagic fish resources those which have not yet been intensively exploited.

Almost all species groups of demersal fish have been over-exploited. These include: baracudas, croakers, threadfin-breams, monocle breams, lizardfish, bigeyes, miscellaneous and trashfish. The only exception is hairtail, which is still under-exploited. Shrimps and cephalopods have also been overexploited.

The excessive exploitation of these fishery resources, which is specifically shown in the Gulf of Thailand, has been the main cause of the decline in the above-mentioned production. Moreover, the establishment of 200 miles EEZ by the neighbouring states has reduced the fishing grounds of the Thai fishermen more than before.

2. MARINE FISHERIES DEVELOPMENT PLAN

In order to solve these problems and to improve the present situation, the Department of Fisheries has formulated the marine fisheries development plan. It aims at:

(a) the conservation and management of marine resources and environment with a view to ensuring sustained harvest consistently;

(b) the development of small-scale fisheries in order to raise the living standard of the small-scale fishermen and fish farmers;

(c) the development of aquaculture so as to supply the nation with cheaper animal protein and increase exports for earning foreign currency;

(d) providing appropriate guidances to fisheries industries;

(e) the development of offshore fisheries to utilize the under-exploited resources in offshore waters;

(f) promoting fisheries outside the Thai waters through joint ventures or fisheries agreements with foreign countries on the one hand, and the exploration for new fishing grounds and research on environment on the other.

The institutions responsible for these activities are Marine Fisheries Division and Exploratory Fishing Division. In order to meet the above-defined goals, efforts will be specifically concentrated in the following directions.

2.1 Inshore resource research

Inshore resources are divided into five groups: pelagic fish, demersal fish, shrimps, cephalopods and other invertebrates. The research for these resources is carried out by analysing the data on them collected from the inshore waters in both the Gulf of Thailand and the Andaman Sea. The data are collected by the research vessels survey and the sampling survey on commercial vessels at the selected landing centres. These data are utilized for various purposes. They include the biological features of resources and the basic characteristics of the fisheries on them such as species size composition, length-weight relationship, identification, sex ratio, maturity, fecundity, spawning season, spawning ground, growth, recruitment, mortality, fishing areas and season, catch per unit effort, etc. Concurrently, the ecological study further in deep and monitoring survey on the state of resources are also carried out by research vessels in coastal areas. Through this research, the higher priorities are given to the evaluation of the state of the resources in question which includes the ecological feature, productivity, potential yield and maximum sustainable yield of the resources. The results are taken into account in the formulation of adequate and effective means of conservation and management for the resources, such as mesh size regulation, closure of area and season.

The major lines of the future research plan of Marine Fisheries Division are summarized as follows.

2.2 Gulf of Thailand

2.2.1 Pelagic fish

(a) To study regularly on the size composition of commercially important pelagic fish species;

(b) to study the fishing ground and fishing season of coastal tunas, hardtail scad and trevallies;

(c) to study on the life history of important pelagic fish, particularly the spawning ground and season, in the western part of the Gulf of Thailand;

(d) to carry out tagging experiment for commercially important pelagic fish such as scads, trevallies, Indian mackerel, sardine and coastal tunas to determine growth, mortality and migratory route;

(e) to study on the selectivity of mesh size of purse seine;

(f) to sudy on the parasite that affects pelagic fish;

(7) to assess the state of pelagic fish stocks being based chiefly on catch and effort data with the aid of biological information.

2.2.2 Demersal fish

The future research plan for demersal resources in the Gulf of Thailand will be concentrated in:

(a) Studying the state of demersal fish stocks in the waters where the new conservation measure has been implemented. Trawling and purse seining have been prohibited for three months in three provinces of the western part of the Gulf of Thailand since 1984. The regulation aims firstly at the conservation of Indo-Pacific mackerel spawners and larvae and secondly at the protection of the other resources including both pelagic and

demersal fishes and invertebrates which spawn in the same area and season. The study is expected to provide the useful information on the relationship between the cessation of trawling and these resources. The outcome would be extremely useful to assess the effectiveness of these regulatory measures in comparison with the state of the resources and fisheries in the other areas where such management measures have not been applied.

(b) Assessing the status of trawl fishery and demersal fish resources after the enactment of the limiting enty into trawl fishery in 1982 in the Gulf of Thailand.

(c) Studying on the spawning season and ground and nursery area of demersal fish in the eastern and western parts of the Gulf of Thailand in order to plan for the rehabilitation of the depleted demersal fish stock.

(d) Studying on the population structure of commercially important demersal stocks by size composition analysis.

(d) Studying on the stomach content of demersal fish to examine the ecological status of them in the food niche of the community.

(e) Studying the historical change in stock abundance of demersal fish in the coastal area of the Gulf of Thailand.

2.2.3 Shrimps and cephalopods

(a) To study on the spawning ground and season and the life history of commercially important shrimps and cephalopods.

(b) To study on the size composition of shrimp and cephalopod stocks in the closed area to analyse their recruitment, growth and mortality rates.

(c) To assess the status of shrimp and cephalopod stocks based on catch and effort data with the aid of biological information.

(d) To study on the selectivity of the mesh size of light luring squid lift net.

2.3 Andaman Sea

The main objective is to evaluate annually the state of the exploitation of fishery resources so that the effective management measures for resource conservation could be introduced. It is also expected that the better knowledge on resources and fisheries would facilitate the planning for the management of fisheries and development of aquaculture in the region.

The major lines of the future research plan of the Phuket Marine Fisheries Station, Marine Fisheries Division, are summarized as follows:

(a) Periodic data collection to analyse the annual fluctuation of the abundance of resources, changes in species and size composition. The systematic monitoring for the purpose is carried out by the research vessel, Pramong 3.

(b) Egg and larva survey by the research vessel to determine spawning area and season for important fish stocks.

(c) A study on the distribution, migration route, growth and mortality of Indo-Pacific mackerel, Indian mackerel and round scads by tagging experiments.

(d) A study on the life history of important resources. This includes studies on important segment such as spawning season and ground, feeding habit, growth, recruitment and mortality. The data are mainly collected at selected landing places along the Andaman Sea Coast.

(e) Assessment of the state of the exploitation of pelagic and demersal fish and invertebrate stocks.

(f) Survey of the exploitable fishing ground and the abundance of Venus Shell (*Parphia undulata*)

(g) Development of small-scale fishery. The experimental constructions of artificial reefs aiming at the rehabilitation of depleted stocks in some particular coastal waters is one of the most important directions for the purpose. It is also expected that the artificial reefs would slacken and even prevent from the conflicts between small- and large-scale fisheries which have been commonly observed and have hampered the harmonious development of the fisheries.

(h) Development of mariculture of several species for which breeding/rearing techniques have already been established. These include jumbo tiger prawn (*Penaeus monodon*), sea bass (*Lates calcarifer*), grouper (*Epinepheles tauvina*) and blue swimming crab (*Portunus pelagicus*). The similar techniques for red snapper (*Lutianus argentimaculatus*) and pig face bream (*Lethrinus nebulosus*) need to be established for which the trial is still on an experimental basis.

The activities for the development of small-scale fisheries and aquaculture will be carried out for both the Gulf of Thailand and the Andaman Sea.

3. OFFSHORE RESOURCES

In 1985, Exploratory Fishing Division initiated the exploration for the utilization of off-shore resources which comprised mainly pelagic and deep water resources. Many exploratory survey projects in the central Gulf of Thailand and the Andaman Sea were launched which include deep-sea trawl survey, gillnet survey, long-line survey and acoustic survey. The R/V FISHERIES RESEARCH No. 2, of the Department of Fisheries of Thailand, a stern trawler with 388 GT, 1 000 HP engine modern fishing gear and oceanographic equipments has been engaged in throughout the survey period.

The main objective of the survey is to assess the size, distribution and abundance of fish resources that will be available for commercial fisheries as new or supplementary resources. The preparation for the future examination on shared stocks was also one of the important objectives of the survey.

The most important species caught throughout these surveys were mackerels (*Rastrelliger* spp.), Spanish and kind mackerels (*Scomberomorus commerson*, *Scomberomorus guttatus*), round scads (*Decapterus* spp.), sardines (*Sardinella* spp.), trevallies (*Selar* spp.), coastal tunas (*Auxis thazard*, *Euthynus affinis*, *Thunnus tonggol*), billfishes (*Makaira* spp.)and a few other demersal fish. These resources have been assessed in terms of the magnitude of the estimated potential yield on the scale whether they are possible or not to be harvested by the fisheries on a commercial basis.

In conclusion the programme work of Exploratory Fishing Division in the immediate future are summarized as follows:

(a) Cooperative projects with the neighbouring countries on exploratory survey.

(b) Deep-sea trawl operations in the Andaman Sea in 1986 and 1987.

(c) Tuna longline operations in the South China Sea in 1986 and 1987.

(d) Drift gillnet and bottom long-line operations in the Andaman Sea and South China Sea in 1985, 1986 and 1987.

(e) Acoustic Survey in the Gulf of Thailand, South China Sea and Andaman Sea in 1985, 1986 and 1987.

(f) Egg and larva survey in the Gulf of Thailand, South China Sea and Andaman Sea in 1985, 1986 and 1987.

ANNEX 8

National Fishery Data Centres and Integrated Data Collection

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FAO

1. NATIONAL FISHERY DATA CENTRES AND INTEGRATED DATA COLLECTION

Rational fishery development can only be based on reliable and timely data and information. Users of the data - scientists, fisheries administrators, technologists, economists and investors - interact with fishermen and fish processors all working towards the solution of national and/or regional problems hindering the establishment of viable fisheries.

But, notwithstanding the long experience of many countries in data collection, there are still serious gaps in the availability of reliable data needed to appraise fishery resources and to plan management and development activities. Thus, the need for reliable information is already great, and seems likely to grow if coastal states are to take full advantage of the increased opportunities offered by the new Regime of the Sea.

The information services provided by fishery departments or statistical offices are usually derived from data on fish catches and landings, and trade in fishery commodities. But only in exceptional cases are advisory services offered on data collection, storage and analysis. At its Fourth Session (6-8 December 1984 in Kuala Lumpur) the IPFC Committee for the Development and Management of Fisheries in the South China Sea (CDMSCS) agreed on the need to establish national data centres and recommended that member countries take action to build up the facilities required for the short term. The Committee also welcomed FAO assistance in the standardization of the data collection format and on processing and dissemination.

Any attempt to establish such data centres must be preceded by detailed studies to identify the funds and facilities needed to discharge information and data service functions which will meet the requirements of the users. In order to achieve this, the following background studies need to be undertaken:

(a) Inventory of existing data sets and description of data collection systems, identifying:

- Sources of fishery data such as statistical offices
- Data elements
- Volume of data
- Quality of data
- Data processing methods

(b) Extraction of relevant data elements from existing data sets:

- Funds and staff time
- Recording of data on standard input media

(c) Data centre functions:

- Determination of the structure and funds and equipment required to store and process data
- Identification of the flow of data and frequency of the flow
- Application of adequate processing technology and data storage systems to meet the needs
- Provision of data in accordance with national and international user needs.

Most member countries may find that some data elements required for resource assessment, and fishery management may not be available through the existing data collection systems. This may necessitate the revision or enhancement of current statistical systems, such as improvement of the area resolution, detailed breakdown of catches by species, resolution of fishing effort data for various classes of vessels or fishing units, etc.

Once the full spectrum of user needs and required data elements are identified, the feasibility of collecting the missing data elements must be studied. Such studies require a critical analysis of the adequacy of the existing structure of data collection and identification of sources of funds and extra staff time needed to fill the gaps.

1.2 Integrated Data Collection

In establishing the national data centre structure consideration must be given to the nature and detail of the data to be exchanged on identified shared stocks, and the means by which these data will be compiled for dissemination at regional level. This calls for integrated data collection and processing, using proven formats and methodologies, and the designation of national data centres to compile regional data in symbiotic relationship with the statistical offices and other institutions that may collect data in a country.

The designated national data centres, when established, would serve three operational functions:

(a) Advisory

(b) Archiving

(c) Information Services

2. ADVISORY FUNCTION

Assistance would be given to member countries on the harmonization of their statistics by using standard forms and definitions, and the details required in the data provided. This would lead to the implementation of:

(i) collection systems for catch/effort, commodity and socio-economic data of known quality and precision for shared stocks

(ii) data processing systems for processing, storage and retrieval, to minimize the operational expense of handling the data files

(iii) an institutional and working relationship between the collection and data management units of member countries, and the units using the data.

In addition, a designated national data centre would have stature and expertise for consultation, at an early stage in project formulation, with national experts and Fisheries Department personnel, on projects and tasks calling for data.

3. ARCHIVING FUNCTION

The critical facet in any storage and filing function is acquisition control. The designated national data centre must develop file accession and information retrieval

criteria on which data submitted to the central repository may be accepted. Storing data in any form is expensive, therefore, the kind of data and the format in which it should be submitted and stored needs to be well defined.

In addition this function would have to ensure submission, namely, keep track of questionnaires sent out and follow-up to ensure that timely data files are submitted with the required accuracy and in the required format.

A designated national data centre needs to store integrated data as part of its mandate since most fisheries studies require statistics and data in time series.

4. INFORMATION SERVICE FUNCTION

Obviously, a designated national data centre will be unable to offer information services until the central repository contains data files from which *ad hoc* information can be extracted.

To produce information reports requested by various users, the designated national data centre personnel must be proficient in the use of the generalized file processing system for interrogating files.

Information reports from files may be generated in four ways, by:

(i) Using generalized file processing systems for simple reports

(ii) Using pre-prepared programmes to process the file(s) (e.g., statistical analyses)

(iii) Creating sub-files which, in turn, are used as input to pre-prepared programmes (e.g., scientific applications)

(iv) Using specially designed programmes for situations not catered for in (2)-iii.

5. ORGANIZATIONAL PROBLEMS

A global Fishery Data Centre in FAO Headquarters already exists within the Fishery Information Data and Statistics Service of the Fisheries Department. At present its scope is limited to providing the technical support required to maintain and further develop statistical database systems, and to writing user guides for the operation of these systems. Data generated in the field remain in the field.

Although a considerable amount of data is also available to the Department from outside sources, there are not effective means for processing such data. Threfore, much information is not being made available for management and research decision-making on a regional and global scale in world fisheries.

The establishment of designated national data centres with a clear charter for their functions, would provide the required regional data and information service to the users. Experience in the academic and commercial world has shown that any service is ultimately more effective and accurate if not under the direct control of one major user, an approach which conforms with the policy of a number of management and development organizations. If joint management action for some of the shared stocks in the region is envisaged, it is essential that an integrated database be ultimately established by bringing together data collections from the national data centres.

For reasons of economy an integrated database could initially be established within an existing data centre system. FAO Fisheries Department's Fishery Data Centre could discharge these functions until such time that a regional structure is available to provide all the services at regional level needed by the member countries of the Committee. The funds required for this purpose have been requested for the 1986-87 biennium and, if approved, the following activities are proposed for implementation:

(i) FAO, to organize a workshop in 1986 to identify the precise user needs for data on shared stocks, identify the data elements to be collected and exchanged, as well as the requirements for processing data on modern electronic equipment.

(ii) FAO, to advise the member governments on the collection of data elements not readily available through the national data collection systems.

(iii) FAO, to design standard data collection forms to transmit data for inclusion in the integrated database and develop the communication channels to ensure the flow of data for compilation and tabulation.

(iv) FAO, to organize a seminar to train the staff of designated national data centres in the collection and processing of the national and regional data and statistics.

(v) FAO, to produce annual bulletins on shared stocks to be disseminated to the users in the member countries.

The implementation of the above would require close cooperation between member countries, FAO and SEAFDEC, to ensure the best use of financial resources and to avoid any harmful duplication of effort between all the parties concerned.

Appendix

For information the following background papers are appended to facilitate discussions on the identification of essential data elements, species or stock units, on which regional data may be required, and proposed classification for gear and fishing vessels:

(i) The Collection of Catch and Effort Statistics

(ii) List of Data Elements for Catch Effort Data

(iii) Definition and Classification of Fishery Vessel Categories

(iv) Definition and Classification of Fishing Gear Categories

(v) Time Series of Catch Statistics in ranking order to identify important species on which Data may be exchanged.

CATCH REPORTING FORM

Complete for each unit fished in one day

I. FISHING EFFORT AND GEAR SPECIFICATIONS

Unit area fished (use code on map at back of book)
Registration number of boat
Type of fishing unit (use code for standard fishing unit)
Date of return from trip
Duration of trip
Fishing time - Number of hours
Type of gear in use (use code for standard gear)
Number of hauls/size of gear (if applicable)

II. LANDING POINT

Country of landing (use Country Code)
Landing point (use code for Landing Point)

III. FACTORS EFFECTING THE EFFICIENCY OF VESSEL OPERATION

Steaming time:
From Port to Port

Hove to:
Due to weather conditions
Rest Period

Staying in Port:
Breakdown/overhaul
Closed fishing season

IV. SPECIES FISHED

Species Caught Common/Local name	Weight Caught Whole fish in kg	Amount of Fish Transhipped, sold or consumed at sea Weight Whole fish in kg
1		
2		
3		
4		
5		
6		
7		
Others		

NB: Identify target species by adding letter T in front of species code "T"

Total verified landed weight
Whole fish in kg

LENGTH MEASUREMENT FORM

VESSEL DATE TIME

POSITION
(use code for Unit Area fished)

DURATION OF HAUL DEPTH

SPECIES

CATCH WEIGHT

SAMPLE WEIGHT

M-43
ISBN 92-5-102338-7